ASHISH KOTHARI

UNDERSTANDING BIODIVERSITY

LIFE, SUSTAINABILITY AND EQUITY

TRACTS FOR THE TIMES / 11

UNDERSTANDING BIODIVERSITY

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Understanding Biodiversity

Life, Sustainability and Equity

ASHISH KOTHARI

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Editorial Preface

TRACTS FOR THE TIMES attempts to provide meaningful information, critical perspectives and theoretical reflections on various themes of contemporary concern. They seek to deepen our knowledge of crucial issues, query our common sense, re-think old concepts, and analyse the social and economic problems we confront.

The old maxim about war being too important to be left to the generals is doubly true when it concerns the battle for the environment. We all need to think about nature, not allow it to be a concern of environmentalists and naturalists. Our modernist minds are often uncomfortable with what environmentalists have to say: they appear as romantics, opposed to the idea of scientific progress and unwilling to recognize the ineluctable logic of modernity; they seem to celebrate the past rather than the present, value the world we have lost in preference to the one we have gained. Such modernist minds find it difficult to recognize the close connection that our life and well-being has with such questions as biodiversity, and the link that poverty and starvation has with loss of biodiversity. Recognition when it does come is repressed, for it cannot be easily reconciled with the accepted developmental logic of modern society. To recognize the link is to question the desirability of this logic and to think of models of an alternative modernity.

This tract persuades us to be serious about biodiversity. If plants, animals and micro-organisms re-create the quality of the air that we breathe, the water we drink and the soil which produces our food, if plants provide the natural ingredients for medicines which cure human illnesses for over three-fourths of human population, we have reason to be concerned with the

destruction of biodiversity. While biodiversity has made life possible, human history has tended to erode this diversity. Anthropomorphic ideologies idealized human conquest of nature, and the commercial age transformed nature into a resource to be used and exploited for sale and profit, opening up the animal and plant world to limitless expropriation. The consequences now corrode our lives.

After introducing the key words and issues in the first chapter, Ashish Kothari discusses the processes that have led to the loss of wild life diversity. Expansion of agriculture since the Vedic times slowly denuded the forest cover, but deforestation was limited till colonial times. The demands of the British Navy and the Railway Department in the nineteenth century rapidly exhausted supplies of teak and sal from penninsular India and deodar from the Yamuna Valley. Conservation policies accompanied forest expropriation, but they sought to preserve commercial timber, not biodiversity. Scientific forestry encouraged monoculture and eliminated mixed forests, centralizing control over forest resources and expropriating the rights of local communities. Alienated and angered, villagers refused to check the flames that burnt the forests and the poaching that decimated valuable trees. Monoculture affected not only species of trees, replacing variety with uniformity, and locally useful timber with those that were commercially valuable; it transformed the entire biotic community—the inter-related community of plants, animals and micro-organisms of the region, threatening the lives of those who depended on the local biota.

The predatory practices of our modern civilization eliminates animals just as much as it cuts trees. Hunting is not only a sport, it sustains lucrative commerce. Animal and bird species disappear without provoking much trauma in our man-centred world. Protectionist policies to save endangered species have created their own problems. National Parks, created on the American model, have denied local communities their rights and resources, expropriating in the process over 600,000 people from the various sancturies in India. Discontented villagers have clashed with authorities, poached in the reserves, and turned

destructive. To resolve disputes and conflicts, argues Kothari, it is essential to understand the conservation problems of an area, the customary rights of local communities, and to seek the participation of local people in preservation projects. Collective participation is essential for any meaningful and viable conservation policy. This can only happen when we reject a framework of thought which considers local practices to be inevitably opposed to conservation.

The loss of wild life diversity is paralleled by a similar loss in the sphere of agriculture and animal husbandry. India is a mosaic of agro-ecological zones: each with its distinct species of crops. Farmers have over years experimented with crop and livestock varieties, adapting to local ecological contexts. Different crop species have been evolved to adjust to different water, soil and weather specifications, and to meet diverse social and cultural needs. Mixed cropping stabilizes agriculture and sustains high levels of productivity. Differences in the maturity period implies a staggered pressure on soil and a continuous supply of food. Soil moisture is retained and the risk against crop failure is reduced. Agricultural schemes of the colonial and post-colonial regimes have disturbed these local equilibriums. They have flattened the diversity of soil and water conditions, replaced inter-cropping with mono-cropping, and repressed genetic variety within the same crop species by encouraging commercially valuable strains. High yielding varieties have rapidly lost productivity, and mono-cropping has opened agriculture to higher risks of failure. Within animal husbandry cross breeding with exotic varieties to promote higher yields of animal products has eliminated local species, often more adapted to the ecological conditions of the region. After a complex discussion of the play of these processes (Chapter 3), Kothari emphasizes the need to protect indigenous varieties of crops and animals. What is essential is a careful mix within the cropping regimes on different soils, instead of a general extension of HYVs to all soils.

Finally Kothari explores in rich detail the complex issue of patents. While genetic biodiversity is primarily concentrated in the tropics, over half the world's gene banks are in the west.

Genetic material has freely flowed from the tropics to the west, but livestock and crop transfers from the industrial nations to the tropics has meant financial costs and technological dependence for the tropics. Intellectual Property Rights now seek to consolidate and preserve these benefits by allowing patenting of everything that is genetically engineered, produced by humans, not occurring in nature. Innovations in crop and animal species can all be patented, and imitations excluded from the market. This, as Kothari shows, would have deleterious implications. It would kill local innovation, destroy local knowledge, disrupt community life, homogenize production and restrict biodiversity. Kothari argues persuasively for the need to prevent such destruction of genetic diversity, protect local knowledge as common property, stopping its private appropriation by multinational corporations.

Issues like biodiversity which affect our lives so profoundly cannot be debated within the restricted circle of professional environmentalists. A meaningful conservation policy has to be built not only on the support of specific local communities directly connected to their immediate environment, but on a wider public awareness of the nature of the problem, and a generalized re-thinking on the developmental trajectory of our society. This tract helps us understand the question of biodiversity and think of the measures essential to conserve our nature. But to conserve we need to know this natural world. The shocking fact is that 90 per cent of the world's species are yet to be described.

NEELADRI BHATTACHARYA

Preface

Biological diversity is the new buzzword, the magic door to international funding and global travelling. But shorn of the fashionable adornments which any new environmental concept soon acquires, the term has a power that few others do. It is the base of all that it takes to be human: agriculture, science and technology, cultural diversity... even wisdom. For it is in living within a complex explosion of life that we have developed into what we are. But that is too narrow a focus; biodiversity is the stuff of which nature is made, a celebration of life itself, and its components are the millions of other species with which we share the earth.

A concern for biodiversity has profound implications for the way we as human beings view the world, the way we go about meeting our needs, and way we "develop" to improve our "standard of life". Ancient cultures were often acutely aware of these implications; many tribal and non-tribal farming cultures still are. As modern westernized people, many of us in urban India have lost this concern. That is why we are content with (or resigned to?) eating a couple of varieties of and seeing a handful of animal species around our homes. Anyone who has lived close to nature will testify that this is a greatly impoverished existence. And yet, many of those who continue to live in close proximity to nature, yearn for urban life. Perhaps that is partly because we in the urban world have drilled it into their heads that the only worthwhile diversity is the range of soap and television brands that we can choose from. Or perhaps again, it is because their lives are truly traumatic, having been transformed by the exploitation of their natural and cultural resources by society's powerful elites.

Whatever the reasons for this lack of concern for biodiversity, the fact is that even city dwellers, living their artificial lives, must realise that there can be no life without such diversity. In the introductory chapter, I elaborate on how absolutely essential biodiversity is. But, as I go on to show, since the factors causing the destruction of this diversity lie within our social, political, economic, and moral systems, including in our "development" patterns, any attempts to conserve it will necessarily have far-reaching consequences. Overall, my contention is that we will need to drastically overhaul our developmental models, our wildlife and agricultural strategies, and our relations between and within nations, if we are to achieve the biological security of this country and of the planet.

The tract proceeds along the following lines. Chapter 1 lays out the reasons for considering this subject seriously and explains some of the related jargon. Chapter 2 examines the conservation of wildlife and wildlife habitats. This is done in the context of the long traditions of human use of biological resources of these habitats, and the new threats posed to wildlife from commercial-industrial forces, both of which call for a radical change in conservation policy. Chapter 3 takes a critical look at agricultural policy, from the point of view of conserving crop and livestock diversity, and of reviving farmers' self-reliance and agricultural sustainability. Chapter 4 examines the complex political issues of access to biodiversity and intellectual property rights, while Chapter 5 looks at the equitable sharing of benefits arising from the use of biological resources. Finally, Chapter 6 concludes the discussion with a look at the recent international trends in biodiversity conservation, use, and access; in particular, the Convention on Biological Diversity. Throughout the work, the focus is on India.

This is a vast arena indeed, and this tract does not pretend to be a comprehensive treatment of all the myriad issues encompassed within it. It does not, for instance, go in-depth into the strictly biological or ecological problems which face conservation; nor does it tackle the vexed issues relating to the rapid developments within biotechnology. My own experience on these matters is limited, and while I can pretend to

understand some of the debates related to them, I would be completely out of depth in trying to comment in detail on them. To be sure, some of the major policy thrusts I have presented here can be extended to these matters also; for instance, the brakes I have advocated on the world of intellectual property rights (Chapter 4) could be very wisely applied to the run-away world of biotechnology too, where ethics and social considerations seem to have taken a back-seat to the profit motive and the desire to conquer nature. But I will let the reader decide on the applicability of my policy prescriptions to these untouched topics.

There will undoubtedly be many mistakes and weaknesses in the facts and arguments placed here. I would be very grateful if readers could write to me regarding these, including if they think I am fundamentally incorrect at any place. Respect for biological diversity must, after all, run parallel to a respect for intellectual and ideological diversity!

Acknowledgements

This work began as a collaborative effort with Professor Madhav Gadgil of the Indian Institute of Science. Unfortunately, he had to drop out due to other pressing commitments. However, early discussions with him, as also access to several of his writings, have had a bearing on what is contained here.

My interest in the subject has been nurtured over the last few years by a project documenting the status of biodiversity in India, ongoing at the Indian Institute of Public Administration (IIPA). The team there has been terrific: Shekhar Singh, Sapna Ramakrishnan, Jaya Menon, Miriam Paul, Krishan Kumar, Neelu Sharma, and others.

The section on protected areas in Chapter 2, borrows heavily from work done with Saloni Suri and Neena Singh at IIPA, and has benefited from discussions with Rajendra Singh, Bittu Sahgal, Mahesh Rangarajan, Seema Bhatt, Vasant Saberwal, Neema Pathak, and Vasumati Sankaran.

Vijay Jardhari, Saab Singh, Dhoom Singh Negi, Sarla Behn, Raghu Jardhari, Mala Negi, Kunwar Prasoon, Bhupal Singh, and others of the Chipko and Beej Bachao Andolans, and of course Ajay Mahajan, have inspired much of the thinking on agricultural diversity presented in Chapter 3.

The discussions on access in Chapter 5, and on the Convention on Biological Diversity in Chapter 6, are partly based on work done jointly with Sarika Bhatia, at the IIPA. Blame for my initiation into the Convention process must lie with Simone Bilderbeek; I subsequently stuck to it because of stimulating interactions with her and other representatives of citizen's organizations from various countries, who have enlivened the corridors of various inter-governmental meetings.

Comments on earlier drafts were received from Pratibha Pande, Neema Pathak, and Sunita Rao, who not only contributed original material but also helped me avoid several goof-ups. Harish and Madhu Dhaundiyal, Vishal Thakre, and Sangeeta Kaintura patiently and smilingly keyed in the ever-changing versions of the manuscript, for which I am grateful.

Considerable other material, ideas, and inspiration for this volume have come from people, some of whom are mentioned in the text and references, but many of whom would never be named because the origins of much of the material are simply not known. It is, so to speak, public property, part of the 'intellectual commons'. Most of what goes into a person's 'original' ideas is based on the output of other people, contemporaries or ancestors. In this sense, private rights to ideas (intellectual property rights) are a fundamental mistake. I make no claim to such rights for what is contained in this volume. For reasons of publishing propriety, my publishers may have different ideas!

Finally, how does one thank one's mother, who would make a face every time I mentioned the word 'biodiversity'; my father who was initially critical of this "new fad" but soon realized that I meant business; wife Sunita, who is great at bringing me down to earth during diverse flights of fancy; and dog Sultan, who has for 16 years been the closest reminder that we share this earth with other species? I think I will just express it with a private hug....

1

We Are Not Alone on Earth

This universe is the creation of Supreme Power meant for the benefit of all;
Individual species must therefore learn to enjoy its benefits by forming a part of the system in close relationship with other species;
Let not any one species encroach upon the other's right.[1]

Isavasya Upanishad

We share the earth with millions of other living beings. Just as we humans make up one species, there are perhaps five to thirty million other species: plants like neem and rice, animals like the elephant and the peafowl, and micro-organisms too small to see with the naked eye. India alone has 125,000 recorded species, and perhaps many more times that number which are as yet undiscovered. All these are connected together in one vast, complex web—a web on which each is dependent. This range of life forms, and the habitats they live in, is called biological diversity or biodiversity.

WHY CONSERVE BIODIVERSITY?

Today's hard-headed development planners and vote-hungry politicians, as also many in the general public, may wonder why there is so much fuss about some cuddly animals and

inconsequential plants. Why should we bother about protecting other species, when our own species is facing poverty and starvation? The truth is, poverty and starvation, and several other ills facing humans, are often the result of the destruction of biodiversity. Though we seldom realise it, biological diversity and its components are the very basis of human survival, providing food, medicine, energy, ecosystem functions, scientific insights, and cultural sustenance to over five billion people.

Apart from the importance of biodiversity to humans, there is another prime reason for conserving plants, animals, and micro-organisms: their intrinsic right to life. Like each one of us human beings, every creature does its utmost to preserve its own life, or, sometimes at the cost of its personal life, the collective survival of its species. As human beings we basically respect each other's right to continue living, with as little suffering as possible, and of the primacy of the continuation of our species. There have been instances in history where such a fundamental right was denied, but we consider such instances as barbaric and inequitous, and rightly so. We moderns, however, have tended not to extend the same ethical standards to other species. Several communities in the past had such standards, even if they did not always practise them with rigour. In folk traditions, notably those of tribals and indigenous peoples, there was a similar recognition of the fact that human beings are but one amongst nature's creatures. In India, this was (and in some places continues to be) represented by the widespread tradition of leaving stretches of habitat alone as sacred forests or landscapes, or protecting certain sacred species, of building up elaborate myths and folklore regarding animals and plants as ancestors and totems and gods. When modern ecology talks of the web of life, it essentially reiterates or reinforces this ethic. Nothing gives us the right to laud it over the rest of creation. Some would argue that our might does give us this right, for we alone can dominate the world like we have in the last few centuries. However, the 'might is right' argument has long been considered morally unacceptable, for otherwise there would be nothing wrong with men exploiting women, and, landlords exploiting landless labourers. If we actually are the only creatures which can show

empathy and which have wisdom, as we proudly proclaim, let us show it in our relations with other species.

But for those of our development planners and politicians who are not convinced by the ethical argument, or who point out that such arguments are not valid in a situation where we have to 'develop', let me point out what a critical role biodiversity already plays in our day to day existence, and how it is likely to play an even more critical role in future. What should be understood is that there can be no true and long-lasting development if we continue to erode habitat and species diversity. Here are some reasons why:

- Plants, animals, and even the invisible micro-organisms around us, sustain and recreate the quality of the water we drink, the air we breathe, and the soil on which we grow food. It is our forests, lakes, rivers, grasslands, coasts, seas, and agricultural lands that provide us with oxygen, water, and fertile soil, with food, medicine, clothing, housing, energy, and other material needs. Most of the oxygen we breathe comes from marine algae, whose existence is dependent on a complex chain of diverse life forms and inanimate matter. Where would we be without all this?
- Wild plants and animals still constitute a substantial part of the diet of the majority of the world's rural people, in the case of many forest and coastal people, more than fifty per cent. These species are especially critical as 'famine foods', available at times when crops fail or cannot be grown.
- Three-fourths of the world's population is directly dependent on plants and animals (mostly wild) for its medicinal needs, according to the World Health Organisation. Even modern medicine continues to depend on extracts from living beings: in the United States, about 4.5 per cent of GDP (some $ 87 billion) is made up of economic benefits derived from wild species, and one-fourth of all medicines contain active ingredients from plants. The struggle against malaria was greatly aided by the cinchona tree of South America, which yielded quinine. One insignificant looking plant from Madagascar, the rosy periwinkle, has yielded cures for certain forms of cancer.

- Agriculture, which provides 32 per cent of the gross domestic product in low-income countries, may have of late become technologically sophisticated, but it still depends on traditional crop varieties, and on wild plant relatives of crops. In the 1970s, a wild rice species found in India was found to be resistant to one of the most dangerous pests (a species of plant hopper); genes from this plant were used to save millions of hectares of cultivated rice in South and South-East Asia from being destroyed by a major epidemic. Diversity within agricultural systems is also crucial to the stability of farmers (see Chapter 3).
- Fisheries, which is heavily dependent on the maintenance of aquatic biodiversity, contributes about 100 million tons of food worldwide (86 per cent of this from marine areas), which is greater than the contribution made by livestock or poultry.

Over centuries, knowledge and materials from wild plants and animals have revolutionalized agriculture (the cross-breeding of crops with wild relatives which have resistance or other desired characteristics), industry (rubber, cotton), medicine (quinine), and other fields of human endeavour. Since the great majority of the world's species remain unexplored for their potential, there is no doubt that further revolutionary discoveries, such as cures for various kinds of cancer, are in store. But we will be able to tap this potential only *if* we are able to save these species in the first place.

DESTROYING BIODIVERSITY

Like water, air, and soil, biological diversity is the hub of the wheel of life. Destroy it, and the wheel, however technologically sophisticated, will no longer run.

Unfortunately, human activity, especially in the last few decades, has ended up causing large-scale loss of biodiversity. A single species, the one to which you and I belong, now dominates much of the earth's land surface, and even parts of its seas. If you overfly the Indian landmass, or for that matter over

almost any other region of the world, the human impact is starkly visible: vast stretches of cultivated rectangular patches, large expanses of concrete jungle, thousands of artificial reservoirs, a network of roads, railways, and canals snaking across the landscape, and in isolated patches here and there, a forest or a natural wetland.

These landscape changes, along with activities like hunting, fishing, pollution, and the introduction of organisms from one region to the other, have brought about a severe and continuing erosion of biodiversity. Most of the world's ecosystems are under threat, with one-fifth to one-fourth of forests already destroyed and the rest going at the rate of over 100,000 sq. km. every year. The majority of the world's freshwater wetlands are being drained or polluted, and the grasslands are diminishing rapidly.[2] The extinction of species has accelerated manifold over its natural rate; whereas in pre-human times four out of ten million species would be wiped out each year, the human period is seeing *extinction rates which are thousands of times greater.* In the time it takes you to read this book, several species would have gone into oblivion. Some scientists estimate that extinction is now at the rate of one an hour, others say one a day.

Extinction is forever. No human agency, not even the most brilliant scientists, can recreate a species once it disappears. Like the wiping out of entire human tribes and cultures, the extinction of a species is a tragedy of massive proportions. It is frightening to think that what has taken nature millions of years to evolve, we can put to nought within a couple of centuries. It is not only the global loss of wild plant and animal diversity which has attracted attention, but also the erosion of genetic diversity in crops and livestock (including poultry). A large proportion (no one knows precisely how much) of the varieties and breeds used in traditional agriculture are no longer in active use (though many of these are stored in frozen gene banks), having been displaced by a handful of new, laboratory bred crops and livestock. Examples of such loss in India are given in Chapter 3. The human landscape is increasingly characterized by monotony: a single breed of livestock adapted by thousands of

shepherds and, mirroring this, a single consumerist culture sweeping across communities and nations.

Simultaneous to the loss of biological and cultural diversity, and in fact one of its root causes is the increasing inequities in access to resources, and a share of the benefits arising from the use of these resources. The aims of justice and equality appear to be universally held now, along with the aims of conservation and the sustainable use of resources. However, these aims still remain distant dreams. Internationally, the industrial nations have benefited tremendously from access to the biodiversity of the tropics, while denying free access to the resulting biotechnological products or a share in the economic returns. Within each nation, including within India, local communities have been squeezed of their resources and knowledge by dominant classes, without commensurate returns in cash or kind. The rapidly expanding world of patents and other intellectual property rights is only intensifying these inequities, and threatening the maintenance of biodiversity. The most recent trends in international law, represented by the General Agreement on Trade and Tariffs (GATT) and the Convention on Biological Diversity, are likely to have contradictory effects on the goals of conservation, sustainable use, and equitable benefit-sharing. Within nations, however, there is increasing demand for local community participation in decisions relating to natural resources, and everywhere, mass movements and individual groups are fighting against the monopolization of biological and intellectual resources.

KEYWORDS

Before we discuss these themes we need to understand the keywords of discussion. The term biodiversity encompasses not only *wild* flora and fauna ('wildlife'), but also *domesticated* plants and animals. The former include species which are relatively untouched by humans, the latter those whose evolution and/or behaviour are substantially influenced by humans. More commonly known terms for these would be wildlife (animals,

plants, and micro-organisms found in nature), and domesticated diversity (crops and livestock). Since the measures for conservation of these two kinds of biodiversity are fairly distinct, they are dealt with separately in this tract.

Scientists usually distinguish three levels of biodiversity:

- Genes: This is the diversity of basic units of hereditary information which are passed down generations, found within a species (e.g. different varieties of the same rice species). This diversity is expressed through terms like subspecies, breeds, races, varieties, and forms. While applicable to all species, the discussion on genetic diversity in this book is primarily focussed on agricultural species. It is in the case of crop species that human influence has been remarkable, with the development of hundreds of thousands of cultivated varieties.
- Species: This is the population diversity of organisms that interbreed, or are reproductively isolated from other such populations (e.g. different crops like rice, wheat, tomato, maize…). Species are the most commonly discussed level of biodiversity. Comparisons of the diversity found in different countries or ecosystems, for instance, are almost always based on species number. Some 1.7 million species have so far been described worldwide, but there may be anywhere between 5 to 30 million, the rest still awaiting discovery by science.[3]
- Ecosystems: This the diversity of ecological complexes, or biotic communities, found in a given area (e.g. forests, waterbodies, grasslands). Ecosystems comprise a biotic community (an inter-related community of plants, animals, and micro-organisms), along with its abiotic (soil, stone, air) habitat, with some identifiable boundary. These can include very broad categories, e.g. a forest is an ecosystem dominated by trees; or they can be more specific categories, e.g. a wet evergreen tropical forest is an ecosystem dominated by evergreen tree species and high rainfall.

Apart from the variety of habitats and life forms found in an area, it is also important to understand their *distribution*. Some species may be commonly found in a wide variety of ecosystems,

others highly specialized to a particular ecosystem. Another way to analyse distribution is to assess whether a species belongs to a particular area or ecosystem, or is alien to it i.e., whether it is *indigenous* or *exotic*. For instance, as far as we know, rice is indigenous to India, while chillies are exotic, having been brought in from South America. However, even after such introduction, such exotic species may diversify further; there are several varieties of chillies which have been developed in India and are not found in South America.

Also of critical conservation importance is *endemism*, or the degree to which biodiversity components belong exclusively to a particular geographical area. For instance, two-thirds of the frogs and toads found in India are endemic. Such species are naturally more vulnerable to extinction, since their disappearance from a single area could mean their disappearance from the entire world. Thus the island chains of India (Andaman and Nicobar, and Lakshadweep), as also the Himalayas, and the Western Ghats, which display high endemism, merit special conservation attention.

In any discussion on the status of species, those falling in the 'threatened' category attract maximum concern. This category is a broad one, encompassing species which are at various stages of actual or potential threat (extinct, critical, endangered, vulnerable, susceptible). The most widely accepted definitions of these terms are those given by the World Conservation Union and are used in their Red Data Books of globally threatened species. Unfortunately, there is as yet no similar standard definition for ecosystems under threat. In this tract, I have simply considered an ecosystem as threatened if it is rapidly or continuously declining in extent and diversity.

It is also important to keep in mind the distinction between *biological diversity* on the one hand, and *biological resources* on the other. The latter refers to specific components of diversity which are of human use. Putting a value on one biological resource (e.g. the sandalwood tree) is not the same as valuing biodiversity (e.g. the complex of trees found in the forest where sandalwood grows); similarly, discussing a single species like the life-history

of a tiger is not discussing biodiversity which is the variety of species and habitats within which the tiger survives.

Finally, it is crucial to recognize the relationship between biological and cultural diversity. The diversity of natural ecosystems and species is one basis of cultural diversity, as different human communities have devised a remarkable range of practices, rituals, technologies, and social relations in response to the challenges and opportunities presented by their natural surroundings. India has a rich cultural diversity, including 4635 distinct ethnic communities, 325 languages belonging to 12 language families, six 'major' religions and dozens of smaller independent faiths, three racially distinct resident populations, and ways of life ranging from ancient hunter-gatherer to modern urbanism.[4]

The complex juxtaposition of biological and cultural diversity in India is no coincidence. The latter has arisen, at least partly, by human adaptation to the former, and has in turn nurtured it. The widespread traditional practices of protecting patches of natural habitator 'sacred groves' and certain species, the myriad myths and folklore representing animals and plants as ancestors and totems, lifestyles which were incredibly fine-tuned to the rhythms and limits of their natural surrounds, hunting practices which respected nature's limits: in all these and other ways local communities have expressed a profound understanding of their relationship with nature.[5] An understanding of the relationship of societies with their natural surrounds is critical to the development of long-term environmental policies and programmes. Chapter 2 focusses on this while discussing the problems and prospects of wildlife conservation.

Human adaptation to natural biodiversity is best seen in agriculture. Through centuries of trial and error, innovation and experimentation, Indian farmers have developed immense genetic diversity within the crop plants they picked up from nature, and an amazing range of farming practices. Agriculture was never a purely economic activity, but rather intimately connected to aspects of social and cultural life of the community. These aspects are elaborated in Chapter 3.

There has been a sharp decline in the biological and cultural

diversity of India over the last few decades. The relatively harmonious relationship between local communities and nature has soured, primarily due to forces external to both. The dominant elite in India has conventionally viewed such communities, their homelands, and the wildlife inhabiting these homelands, as 'resources' to be subjugated and exploited. Declining local community control over natural resources (e.g. the takeover of forests by British colonialists), the commercialization of these resources for the market, an unsustainable development process, and increasing populations of humans and livestock, are major destructive factors. The tract examines these in relation especially to natural and agricultural systems.

2

Conserving Wildlife

We live in a world where even the most frivolous news captures headlines: But, unfortunately the disappearance in 1993 of several tall, stately visitors, who had been coming to India for centuries, probably millenia, did not make similar news, except within the narrow confines of the country's environmentalists. I am referring to the Great white, or Siberian crane, *Grus leucogeranus*, a regular winter migrant to the Bharatpur marshes in Rajasthan. From an estimated population of 2000 in the 1880s, the number of these birds crashed to just 17 a century later. Desperate attempts to augment their flock and help monitor their movements by introducing captive-bred, radio-collared cranes failed, and in 1993, what conservationists dreaded happened: none came. Three winters later, the cranes made a miraculous reappearance one cold misty morning. But only three of them came. Most experts feel that India may soon not see this bird in the wild unless ongoing measures to introduce some captive bred cranes succeed.

The Siberian crane is not an isolated example. We have lost many species of plants and animals, and are in danger of losing thousands more unless we are able to make drastic changes in the way we treat our natural surrounds. This chapter dwells on what these changes could be. Rather than take on the whole gamut of wildlife issues, I have chosen to focus much of the discussion on India's ambitious attempt to conserve what remains of its 'natural' habitats. Comments are also offered on some related issues.

India has a biological and natural diversity matched by few other nations. The world's greatest range of altitude, rainfall, and geological conditions has given rise to an enormous diversity of ecosystems: forests, wetlands, coasts, grasslands, seas, deserts. Each of these major ecosystems displays great internal diversity. Our forests, for instance, range from the arid thorny scrub of north-western India to the lush evergreen rainforests of the Western Ghats and the north-east. Three decades ago, foresters H.G. Champion and S.K. Seth distinguished 16 major subgroups and over 200 types of forests;[1] more recently, ecologists M. Gadgil and V.M. Meher-Homji have categorized 42 different vegetation types.[2] Grasslands, an ecosystem distinct from forests, are classified by scientists on the basis of dominant plant composition, but even as a lay person one can distinguish between Himalayan pastures, the tall grasslands of the terai (Indo-Nepal border) region, and the rolling meadows of the Western Ghats. The Asian Wetland Bureau suggests that there are at least eight major kinds of wetlands in India, including freshwater and brackish lakes, rivers, marshes, tanks and reservoirs, and seasonally inundated lands. Deserts, too, are not only of one kind: the sand desert of western Rajasthan has very different characteristics from the salt desert of the Rann of Kutch (a unique ecosystem built from the interplay of extreme aridity and periodic inundation by seawater), and both are distinguishable from the cold deserts of Ladakh and Lahaul-Spiti. Coastal areas have a great variety of beaches, coral reefs, and mangrove vegetation. Then there are the permanently snow-bound areas of the Himalayas, and the vast waters of the deep seas off India's coasts.

Many of these ecosystems co-exist in larger units called "biogeographic regions". A comprehensive exercise to delineate such regions for the country has recently been carried out by W.A. Rodgers and H.S. Panwar of the Wildlife Institute of India.[3] They grouped India's natural habitats into 10 major biogeographic zones, distinguished on the basis of their species composition and geographic distribution: trans-Himalayan (Ladakh and Lahaul-Spiti), Himalayan (west to east), desert (western India), semi-arid (Aravallis down to the Deccan

plateau), Western Ghats, the Deccan peninsula, the Gangetic plains, coastal, north-east (barring the Himalayan ranges), and Island groups (Andaman and Nicobar and Lakshadweep).

This habitat diversity supports a recorded figure of 81,000 animal species and 45,000 plant species,[4] and possibly several times more yet undiscovered (see Appendix 1). This represents about 6.5 to 7 per cent of the recorded species worldwide; remarkable, for India has only about 2 per cent of the world's landmass. The list is being constantly added to, especially in the case of lower plants and invertebrate animals; scientists estimate that the actual diversity is probably several times what is yet recorded. In the case of micro-organisms like bacteria and viruses, we have probably only scratched the surface; even globally, it is estimated that only about 3 per cent of micro-organisms have as yet been recorded.

Of the 45,000 plant species, about one-third are flowering plants, and the others non-flowering like fungi, ferns, mosses, and algae. Of the animal species so far recorded in India, insects alone account for over 50,000 species. Amongst insects, *Lepidoptera* (butterflies and moths) are relatively well-known, except perhaps from some remote parts of India. Already about 13,000 species of butterflies and moths have been identified; birds number over 1200 species, about 14 per cent of the worldwide estimate.[5] Though most parts of India support a diversity of fauna, some regions have especially high concentrations. For instance, in the case of mammals, Assam in the north-east contains 85 (sixty-three per cent) of the 135 genera of land mammals recorded in India. High reptilian (especially snake) and amphibian concentrations occur in the Western Ghats.[6]

Endemism (see Chapter 1) amongst India's biodiversity is high. According to the Botanical Survey of India, about 33 per cent of the flowering species, and 18 per cent of the total, are considered to be found only within our boundaries. These are concentrated in the floristically rich areas of north-east India, the Western Ghats, north-west Himalayas, and the Andaman and Nicobar Islands. Amongst animals, nearly two-thirds of amphibians (frogs, toads, newts) are confined to India; of these,

a majority occur in the Western Ghats.[7] Amongst reptiles, nearly half of the 153 species of lizards found in India are endemic, with a large number being found, once again, in the Western Ghats.

It is said that traditional communities lived in harmony with India's environment and wildlife. Whether one accepts this statement or not depends on how one defines 'harmony'. Certainly, it cannot be claimed that tribal or other traditional communities had no irreversible impact; across the world, certain kinds of hunting, and the expansion of agriculture, have led to the destruction of natural habitats and the extinction of plant and animal species. However, until recent times, this impact was small, compared to the scale and kind of changes that modern societies are bringing about. Moreover, there were (and in some places continue to be) several traditional beliefs and practices which, in combination with the absence of technologies of mass destruction, consciously or inadvertently led to conservation. Such beliefs and practices were, till recently, singularly missing in industrial society.

It is difficult to pinpoint an exact time in India's history when the human impact on nature changed from being relatively low to becoming massive and drastic. Simplistic observations suggest that the point may have been the early part of this century, when our population started rising dramatically. However, environmental historians like Ramachandra Guha record evidence of mass forest destruction before that, to a lesser degree during the Aryan invasion of tribal areas, and most dramatically during the British colonial phase. *It is in fact clear that rather than demographic trends, it is the kind of policies and control mechanisms governing India's natural resources, which is at the root of destruction.* The example of forests will illustrate this.

Policies regarding the management of forests have had a major bearing on the utilization and conservation of biological diversity, especially since a large part of India's diversity is intimately connected with forests. There are innumerable examples of the self-imposed constraints to forest use, amongst traditional societies. Ecologist Madhav Gadgil and historian Ramachandra Guha have listed ten broad categories of such restrained use, including quantitative restrictions on harvests of

certain species, abandonment of harvests if a species is seen to be declining, rotational use of habitats, seasonal ban on exploitation (including hunting and fishing), and others.[8] There was also a widespread network of forest patches set aside by local communities as 'no-use' zones, including the sacred groves in the Western Ghats (*kavu* in Kerala, *devrai* in Maharashtra, *kan* in Karnataka), several parts of the north-east, Uttarakhand and other parts of the western Himalayas, Bastar and across the rest of Central India (*sharana*), tribal areas of West Bengal, and the Aravalli ranges of Rajasthan (*oraons*).[9] Social and religious injunctions prevented even the cutting of dead wood or picking up of leaf litter within many of these groves. Though many of these groves have disappeared under the force of modernization and commercialization, in some pockets they survive, and are reported by scientists to contain species which have been wiped out elsewhere.

The Aryan attempt to subjugate tribes may have led to some deforestation;* the expansion of agriculture would have led to more.[10] However, much of the destruction was restricted to areas in the plains, and substantial parts of India remained under forest or grassland cover, until the British came. Current levels of deforestation in India are rooted in commercially-oriented forest use and the centralized control policies of the colonial government, policies which continued for decades even under post-Independence governments.

There are several examples of the commercial onslaught of colonial policies. The British Navy's need for durable timber (for shipbuilding) was increasingly met from India, mainly from teak (*Tectona grandis*) forests.[11] Towards the middle of the nineteenth century, the laying of a railway network in India also demanded great chunks of forests to make sleepers. For instance, between 1869 and 1885, over 65,00,000 sleepers were made from deodar

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* Gadgil and Guha cite historian Iravati Karve's work to suggest that the burning of the Khandava forest, described in horrific detail in the Mahabharata, is probably a depiction of the deliberate burning of forests by invading Aryans to hit at hunting-gathering tribes.

(*Cedrus deodara*), extracted from the Yamuna valley forests in the Himalayas, which in turn was necessary because the supply of teak and sal (*Shorea robusta*) from peninsular India was getting exhausted. During World War II, forests were mercilessly hacked to produce charcoal.

While colonial policies towards India's natural resources can only be expected to have been exploitative, it would be reasonable to have expected independent India's governments to change these policies. Yet, a predominantly commercial orientation to forestry continued well after Independence, feeding a rapidly growing industrial demand, that too at heavily subsidized rates. The current demand for industrial wood is twice the amount that forests can sustain. Till recently, even some national parks and sanctuaries were subjected to timber logging operations. A survey in the mid-1980s revealed that 25 national parks and sanctuaries, totalling 11 per cent of the areas studied, had commercial forestry going on in them.[12] Though clearfelling has now been banned, unsustainable logging continues in various parts of India. The focus has shifted to areas like the north-east: thus most of India's plywood demand is met from the rich forests of Nagaland, and even remote areas in Arunachal Pradesh are increasingly feeling the pressure.

Conventionally, forest departments in India have prescribed scientific methods of wood harvesting for sustained yields. However, felling targets and prescribed practices have been difficult to enforce, especially in the early phase when operations were largely entrusted to private contractors. In the Himalayas, felling was often haphazard, logs were illegally rolled down slopes, the roads leading up to forestry sites were poorly designed, all of this resulting in far greater damage and the regression of forests into scrub and grassland.

Secondly, even where prescriptions were followed, the methods used were not conducive to the maintenance of biological diversity. Foresters and scientists in India simply do not know enough about the intricacies of a tropical forest system: there is not even a comprehensive list of all the living organisms from a single hectare of any one tropical wet forest, let alone knowledge of the inter-relations between these organisms. In

such a situation, one wonders if it is possible to carry out forestry while maintaining biodiversity conservation objectives. In the biologically rich Andaman and Nicobar Islands, for instance, at least a part of the commercial logging (started in 1853 to feed various wood-based industries located in the islands), was done using the Andaman Canopy Lifting Shelterwood System. Supposed to be a sustainable system, it appears to have promoted some commercial species and changed the character of the rainforest, possibly at the expense of the natural diversity of vegetation. The former Inspector-General of Forests, S.K. Seth, stated that "though the method is well suited to these islands, a slightly different spectrum of vegetation compared to the original crop results... there is greater preponderance of deciduous elements."[13] The Island Development Authority decided in the 1980s to phase out commercial logging in these islands by the end of the century; shockingly, the then Union Environment Minister Kamal Nath subsequently granted a 15 per cent increase in the logging quota, increasing the harvest from 100,000 cu.m. to 115,000 cu.m!

In many parts of India, the promotion of a few favoured species has been carried to an extreme through the ironically-termed "enrichment plantation", in which a single commercially valuable native species has been extensively planted and other species eliminated. This is the case, for instance, with teak monocultures in south India, or Chir pine *Pinus roxburghii* plantations in the Himalayas. Perhaps worse, mixed forests have in many areas been replaced with plants exotic to the ecosystem: Himalayan oak *Quercus* spp. and *Rhododendron* forests with Chir pine *Pinus roxburghii* plantations, mixed deciduous stands in the northern plains with *Prosopis juliflora* stretches, southern deciduous and even evergreen forests with eucalyptus monocultures, north-eastern and southern hillside forests by vast tea, coffee, and other cash crop plantations, Andaman and Nicobar rainforests by betelnut, coconut, and rubber plantations, and so on. Even national parks and sanctuaries have not been spared. In the mid-1980s, as many as 44 national parks and sanctuaries (19 per cent of the 235 surveyed by the Indian Institute of Public Administration)

reported the deliberate introduction of exotics—eucalyptus was the most common species, having been planted in 18 of these 44 protected areas.[14] No estimate is available of the loss of biodiversity such conversion resulted in, but it must undoubtedly have been substantial.

The second major policy thrust affecting India's forests has been the increasing centralization of control. Starting with the British take-over of large chunks of forests, by their declaration as Reserved or Protected Forests under the Indian Forest Act, and going on with the creation of supposedly "human-free" national parks and sanctuaries under the Wild Life (Protection) Act, the trend to bring forests under bureaucratic control has alienated the local communities who for centuries used and conserved them. Their access to livelihood resources denied or restricted, their role in the upkeep of forests curtailed, their immense knowledge neglected and even derided, and their own members succumbing to market pressures and ignoring traditional restraints, it is not surprising that villagers do not cooperate with the Forest Department in stopping forest fires, reporting poachers and timber thieves, or in other ways helping to conserve forests and wildlife. In many areas they have become downright hostile to the forest bureaucracy, and physical clashes are not rare. Having alienated local people from local resources, government agencies are unable to fulfill the responsibilities they have taken upon themselves. This aspect is dealt with in greater detail in the next section, with respect to wildlife habitats.

Commercial forestry practices and centralization of control are not the only factors causing biodiversity loss in forests. Possibly the greatest wound inflicted on Indian forests before and immediately after Independence was agricultural expansion, often state-sponsored. Between 1951 and 1980, according to the Forest Survey of India, over 26.20 lakh hectares (26,200 sq. km.) of forest areas was converted for agricultural purposes all over India.[15] Substantial parts of the tribal belts, especially in north-eastern and central India, have been deforested or degraded by shifting cultivation (*jhum*). According to satellite imagery, in 1984 some 62,85,400 ha. (62,854 sq. km.) of forest land in the north-east was affected by shifting cultivation. Once a

sustainable mode of resource use in fragile ecosystems unable to bear permanent cultivation, the increase in population pressure and the takeover of forests by the state or private agencies has forced shifting cultivators into shorter and shorter cycles of cultivation, not allowing the forest to regenerate adequately before it is again burnt, and encouraging the spread of weeds.[16] Undoubtedly, this has entailed a considerable loss of biodiversity, though no accurate measurements appear to have been done so far.

Large-scale development projects have also contributed substantially to the loss of forests. Between 1951 and 1980, 5,02,000 ha. (5020 sq.km.) of forest were diverted for river valley projects.[17] Large-scale diversion continues with projects like the Narmada Sagar Project in Madhya Pradesh, which threatens the inundation of 40,000 ha. of forest;[18] the Bodh Ghat Hydro-electricity Project in the Bastar region of Madhya Pradesh (currently stayed by sustained opposition) with the submergence of over 5700 ha. of moist deciduous forests that have rich genetic potential;[19] the proposed Tipaimukh dam, threatening over 200,000 ha. of relatively undisturbed forests in Manipur and Mizoram.[20]

Other 'developmental' factors in deforestation include mining. I have seen substantial chunks of moist deciduous and evergreen forests in Goa laid bare by iron-ore mining, much of the raw material headed for Japan. In 1995, the Rajasthan government initiated moves to dereserve forest areas to allow mining. Even national parks and sanctuaries have not been spared; dolomite and marble mining have destroyed large areas of forest within and adjacent to the Sariska Tiger Reserve and National Park in Rajasthan. In the Buxa Tiger Reserve, West Bengal, ongoing dolomite mining, apart from causing considerable ecological damage, falls in the critical transitional zone between the high altitude ecosystem of Bhutan and the ecosystem of the Duars in the plains of India, and has consequently blocked the migration route of several species.[21] In Himachal Pradesh, the "single most important locality for Chir pheasants in the world",[22] the Majathal Sanctuary may be threatened by limestone mining to feed an upcoming cement factory nearby.

Many foresters and environmentalists hold that the greatest degrading factors in the case of forests are grazing and fuelwood collection. Available figures indicate that there is some substance in this argument, though the matter is complicated by the fact that a substantial part of the fuel-fodder demand is met by lopping and leaf cutting, rather than by felling entire trees. Where, however, there is urban demand, as in the case of the several thousand wagonloads of firewood coming into Delhi every year, complete tree-felling may be involved. The total fuelwood demand is 235 million cu.m., but only 40 million cu.m. can be sustainably extracted from forests.[23] In addition,about 500 million livestock population is supported by forests and grasslands.[24] The total availability of green fodder from grasslands, agricultural wastes, and sustainable extraction from forests, is about 434 million tonnes, but the demand is about 882 m.t.[25] The pressure of grazing on forests has greatly increased not just due to a rise in livestock numbers, but also because pasture lands have been taken over for various purposes, including irrigated cultivation and urbanization. Such excessive biotic pressure is a major factor in biodiversity loss in Indian forests.

Most of the factors which have led to the destruction of forests, have also been at work in the case of other ecosystems: grasslands, wetlands and marine areas. Grasslands, in fact, are perhaps India's most neglected, and most extensively devastated, ecosystem. Agricultural expansion and irrigation networks have converted hundreds of thousands of hectares, urban expansion and development projects have eaten into thousands more, and fire and overgrazing have degraded much of what remains. The semi-arid grasslands of western India face the world's heaviest grazing pressures. Ironically, forest departments in several states have planted grasslands with trees (e.g. teak, wattle, and eucalyptus in south India), in a mistaken attempt to make them 'more productive'. Finally, several exotic weeds like *Eupatorium* and *Parthenium* have invaded large stretches of grasslands. Less than 4 per cent of India's landmass is today under permanent grass cover.[26]

Wetlands (defined as lands which are permanently or

seasonally under water, including coastal areas upto a depth of six metres) have also been severely abused all over India, by drainage or reclamation for agriculture and construction, blockage by dams, pollution of various kinds, siltation from degraded catchments, invasion by weeds like hyacinth and exotic animals, overfishing, and other factors. One-third of India's wetlands may have already been drained out, and a national survey by the Government of India, of 93 important wetland areas, revealed that degrading factors had seriously threatened the continued survival of at least 18 of these sites: Dal Lake, Wular Lake, Harike Lake, lakes near Haideragarh, Dahar and Soj lakes, the Gulf of Khambat, Khabartal, Dipor Lake, Loktak Lake, Salt Lake swamps, the Sunderbans, Chilika lagoon, Kolleru Lake, estuaries of the Karnataka coast, Kaliveli tank and Yedayanthittu estuary, the Cochin backwaters, and the wetlands of the Andaman and Nicobar Islands.[27] Many wetlands are disappearing before our very eyes: Sukhna Lake (a sanctuary) in Chandigarh is down to one-fourth its original size, and the famous Dal Lake of Srinagar may vanish within the next fifty years, both due to silt inflow from the neighbouring deforested hills.[28] Several rivers and streams have been rendered almost lifeless by the construction of dams, which reduce the downstream flow of water and nutrients, block fish migration, and cause chemical and physical changes that destroy the aquatic ecosystem. The Loktak Lake in Manipur, unique in the world for its masses of floating vegetation (*phumdi*) spread over several hundred square kilometres, and home to one of the world's most endangered mammals (the brow-antlered deer *Cervus eldi eldi*), is threatened by hydrological changes caused by an upstream hydro-electricity project. And the majority of wetlands are also facing serious pollution problems, as millions of kilolitres of domestic, industrial and agricultural wastes flow into them.

Habitat destruction, hunting and over-exploitation, pollution and poisoning, and displacement by exotics over the last few decades—a heady cocktail of factors has led to the decline in India's wild biodiversity. With over half of India's natural forests gone, one-third of its wetlands drained out, 70 per cent of its surface waterbodies polluted, 40 per cent of its mangroves wiped

out, and the continued hunting and trade in 'game' animals and commercially valuable plants, thousands of plant and animal species are heading towards extinction.

No one knows how many species have already become extinct in India; we know of only a few larger animals and some plants. These include mammals like the cheetah *Acinonyx jubatus,* birds like the pink-headed duck *Rhodonessa caryophyllacea,* and plants like *Madhuca insignis* (a wild relative of the mahua, one of central India's most widely used trees).[29] But for every one that we know of, there are probably several which have disappeared without a trace, simply because no one knew they existed. This would be especially true for smaller animals (like insects) and plants, and for species which have a very restricted range and specialized habitat or food requirements. The botanist Cecil Saldanha reports that the grass *Hubbardia heptaneuron,* which grew only in the spray zone of the famous Jog Falls in western Karnataka, has not been recorded since the construction of the Sharavathy Hydroelectricity Project, a victim perhaps of river flow changes.

If current trends continue, several thousand species may join the cheetah and *Hubbardia heptaneuron* on the extinction list. No clear estimate exists, but official sources suggest that about 10 per cent of the flowering plants, over 20 per cent of mammals, and about 5 per cent of birds are at various stages of threat.[30] Scientists Madhav Gadgil and V.M. Meher-Homji have given a far worse prognosis; taking well-known models of species extinction based on habitat loss and fragmentation, they estimate that over a third of India's total plant and animal diversity may be lost within the next few decades.[31] That would mean about 45,000 species—a great tragedy by any scale of judgement.

It was in the context of this rapid decline in wildlife populations over the last few decades, that conservationists called for a national wildlife protection programme in the 1960s and 1970s. The thrust was towards protecting remaining populations of certain endangered species, by banning hunting, giving legal protection to their habitats, and restricting trade in wildlife. The Indian Wild Life (Protection) Act was promulgated in 1972, with various provisions for protecting habitats and an all-India list of protected species. Almost every state government

responded by establishing national parks and sanctuaries, and the central government announced several projects for protecting specific animals which were gravely threatened: the tiger (*Panthera tigris*), the one-horned rhinoceros (*Rhinoceros unicornis*), the Kashmir stag or hangul (*Cervus elaphus hanglu*), all three crocodiles (the freshwater *Crocodilus palustris*, the saltwater *C. porosus*, and the Gharial *Gavialis gangeticus*), the Asiatic lion (*Panthera leo*), and others. More recently, the Indian elephant (*Elephas maximus*) and the snow leopard (*Panthera uncia*) have also been made the beneficiaries of special conservation projects, and the highly endangered bustard family is proposed to be brought under a special scheme. Over a thousand species have been given full or partial legal protection against hunting and trade throughout India.

Every one of these measures has played a part in safeguarding India's wildlife. Without them, many of the above-mentioned species and others, would have joined the cheetah on the list of extinct animals. Project Tiger brought the tiger back from the brink of extinction (though it is of late again slipping back), and helped to conserve large natural habitats of several other species. Were it not for strict protection given to the rhinoceros in Assam, at a time when its population was a precarious low, it too would have been a mere memory by now. There are many other species for which this can be said.

By no means, however, has the conservation effort been adequate. As has been characteristic of the last few decades of conservation worldwide, the focus has been on a few 'charismatic' species, typically large animals which attract a lot of public attention. No special attention has been given to smaller species, especially insects and other invertebrates. The Wild Life (Protection) Act of 1972 till recently did not give legal protection to these creatures. No special project or reserve has been declared for invertebrates, which comprise nearly half of India's biodiversity. Of course, in the process of protecting larger species, 'lesser' species have got some protection, but this is incidental and may leave out significant populations and habitats of these smaller animals and plants. There is now also evidence that management measures aimed at megafauna have at times

adversely affected their smaller companions; for instance, the burning of grasslands aimed at benefiting large ungulates in several habitats of Assam and Uttar Pradesh is leading to the severe decline in the already threatened species like the hispid hare and the pygmy hog.[32]

With a newfound focus on biodiversity, rather than on a few of its components, there is now a more intensive search for different conservation measures. Increasingly, even insects are beginning to find a place in conservation planning; notifications under the Wildlife Act of 1980 and 1986 added several hundred butterflies, moths, and beetles, and one dragonfly to the list of protected species. In 1991, plants were also added for the first time, starting with six species. Hopefully, there will soon be a Project Moth, and a Project Tree Frog!

Such shortcomings aside, the most serious problem with India's official conservation efforts has been its socio-economic impact. In the last few years, some of these measures have come under heavy attack for being socially unjust, and therefore short-sighted. Specially targeted has been the country's most ambitious conservation effort, the creation of a protected area network. A whole series of social and developmental conflicts are erupting in and around these areas, many of them so serious that they threaten to undo whatever gains we have made in the last few decades. These conflicts, and the new direction in which India's wildlife policies must head in order to resolve them, are the focus of the next part of this chapter.

PROTECTED AREAS, PEOPLE, AND PARTICIPATORY MANAGEMENT

By late 1995, India had an extensive network of 521 national parks and sanctuaries, covering some 4.3 per cent of its territory.[33] Though a small percentage, these areas are critical repositories of what is left of the country's natural habitats and wildlife, and therefore, well worth protecting. What is often ignored is that they are also home to some of India's most traditional communities, including several hunting-gathering, pastoral, and fishing peoples. Finally, however, these ecosystems

are also the repositories of some of the country's most valuable forest products, minerals, and other resources which our rapidly expanding industrial-urban economy demands. These protected areas (or PAs) thus mean different things to different people, and therein lies the locus of a simmering cauldron of conflicts.

In PA after PA, a variety of issues has surfaced over the last few years, including conflicts between villagers and the government, between villagers and commercial forces, and between conservationists and commercial forces. The examples below will give an idea of the range of situations:

- In some areas, local communities are totally rejecting the official concept of PAs and are even willing to sacrifice the forests and wildlife for immediate gains. In the Narayan Sarovar Sanctuary of Gujarat, many villagers have welcomed the recent denotification of the reserve to make way for a cement factory, since they have got nothing from the forest authorities and expect employment from the factory. In the Shoolpaneshwar Sanctuary of Gujarat, tribals are demanding denotification because they have only experienced hardships in obtaining forest resources, while the authorities have allowed bamboo extraction by a paper mill inside the reserve.
- In several areas, the local people are struggling to conserve these habitats along with government officers, and with the help of national laws, recognizing that only this will secure their own long-term livelihood. In the Sariska Tiger Reserve in Rajasthan, villagers have fought against mining, citing the Wild Life (Protection) Act. In the Kaila Devi Sanctuary, part of the Ranthambhor Tiger Reserve in Rajasthan, resident pastoralists have helped the forest officials fight against mining and the incursions of massive herds of migratory sheep, in return for continued access to pasture land inside the reserve.
- In many areas, villagers are themselves protecting habitats with an explicit rejection of any government involvement. The inhabitants of five villages in the Alwar district of Rajasthan have declared 1200 hectares of forest as the Bhairodev Dakav 'Sonchuri', promulgated their own set of

rules and regulations which allow no hunting, and are zealously protecting the area against any outside encroachments. Several patches of forest in the Himalayas (e.g. at Jardhar village in the Hemval valley) have obtained strict protection from the communities associated with the Chipko movement. Heronries in the village wetlands across south India (Kokrebellur, Neelapattu, etc.) have been conserved for centuries.

- Many PAs have been sacrificed for commercial purposes, in astonishing reversals of the stated positions of governments, and with NGOs standing helplessly by. Himachal Pradesh denotified the Darlaghat Sanctuary in the Himalayas to make way for a cement factory; the same reason drove Gujarat to denotify the Narayan Sarovar Sanctuary in coastal Kutch. In 1994, Karnataka gave fresh mineral prospecting leases inside the evergreen forest habitat of the Kudremukh National Park.
- At several places, bold forest officers and NGOs stand in the way of destructive commercial interests. At the Radhanagari Sanctuary in Maharashtra, local forest officers have dug up the road leading to a proposed mining site, and local NGOs are campaigning to get the mining lease cancelled. NGOs and politicians have successfully stalled attempts to use the Bhitarkanika Sanctuary (home to the world's largest nesting sites of the threatened Olive ridley sea turtle) for trawling jetties, and the Balukhand Sanctuary for a hotel complex.

. Unfortunately, success stories such as the ones at Sariska, Bhitarkanika, and others mentioned above, are becoming rare; more common is news of unresolved conflicts erupting in and around protected areas. These conflicts are understandable only in a historical and socio-political context, as briefly discussed below.

The official declaration of protected areas is not a new practice in India; several scattered reserves have been established by rulers down the ages. In the third century B.C. Emperor Ashoka was the first to specifically protect wildlife by law. Several Muslim and Hindu rulers created reserves for their own pleasure

or for hunting; many of these (Eravikulam, Velavadar, Ranganithittoo) were later to become independent India's national parks or sanctuaries. During the British colonial period too, several reserves were established, e.g. Kanha and Corbett National Parks. The country's first specific wildlife protection law, the Madras Wild Elephant Preservation Act, was passed in 1873. The increased availability of firearms after World War I led to a rise in hunting, prompting renewed concern about the fate of several species. Simultaneously, the realization that entire habitats were threatened led to the establishment of the National Parks Act in 1934, and the creation of India's first national park, Corbett (then Hailey National Park). But the most important step came in 1972, when the Wild Life (Protection) Act (hereafter referred to as the WLPA) was promulgated and extended to all the states of the country. Thereafter, state governments rapidly expanded their network of PAs, the total increasing from 131 in 1975 to 521 today.[34]

This network of PAs has helped to conserve a significant part of India's biodiversity, including a wide diversity of habitats and species. The factors causing biodiversity loss would have gobbled up these areas too if it were not for the protection given. Several examples come to mind: the Marine National Park in the Gulf of Kutch, fighting what is so far a successful battle against a proposed Reliance Industries oil refinery; and the Balukhand and Bhitarkanika Sanctuaries in Orissa and Radhanagari Sanctuary in Maharashtra (mentioned above).

These successes are only one side of the story. The other side is one of considerable human suffering, and conflicts which are threatening to undermine these successes. Contrary to the conventional middle-class image of PAs as pristine habitats untouched by human hands the majority of India's PAs have human communities dependent on them for sustenance and livelihood. A national survey conducted in the mid-1980s by the Indian Institute of Public Administration (hereafter referred to as the "IIPA PAs study") revealed that 69 per cent of the PAs surveyed had human population living *inside*, and 64 per cent had community rights leases, or concessions inside them.[35] The most common activity inside was grazing, present in 69 per cent

of the surveyed PAs, while 57 per cent collected non-timber forest produce. A rough extrapolation of available data from the same survey reveals that there are at least three million people living *inside* PAs, and several million more using them from adjacent settlements.

The declaration of PAs and the imposition of regulations under the Wildlife Protection Act was almost always done without consulting with these communities, and resulted in their rights being terminated or abridged, or access to basic resources being cut off without adequate provision of alternatives. There are several historical reasons for this neglect of local people's rights and needs:

- A considerable part of the influence on Indian wildlife policy and programmes comes from the West. The American-European model which in the late nineteenth and early twentieth century was being applied in the colonial tracts of Africa was also imported to India; the essential feature of this was the 'closure' of natural habitats to human populations. The concept of national parks originated in the United States of America (which set up Yellowstone in 1872): a large area where "one or several ecosystems are not materially altered by human exploitation and occupation", and where the "highest competent authority of the country has taken steps to prevent or eliminate as soon as possible exploitation or occupation in the whole area."[36] It was completely lost on Indian conservationists and administrators that such a model was unsuitable to situations where there is considerable human settlement inside these areas, and a strong dependence on their natural resources.
- Traditional rulers and the British promulgated conservation policies out of concern for the depleting populations of 'useful' animals: those which were favourite hunting targets, or those which could be put to productive use (e.g. elephants, used extensively by the British in forestry operations). These rulers very often held local people responsible for species decline, and so kept them out of reserves as far as possible. When these reserves were

converted to national parks and sanctuaries in independent India, they inherited the legacy of excluding people.

- The main actors in the official conservation process during the British period were princes, British officials or naturalists, their Indian collaborators or counterparts, big-time hunters, and/or other members of the Indian or colonial elite. Most of these individuals were alienated from the vast majority of Indians. While some of them recognized the ecological knowledge and related practices of local communities (and indeed, as hunters or naturalists, used this knowledge), the majority of them were dismissive of traditional systems. The change from British to Indian bureaucracy managing forests and wildlife did not seem to bring in much greater sensitivity to local community interests. Senior officers of the Forest Department come through the Indian Forest Service, which, like all central administrative services, is still heavily dominated by the upper crust of society; the Indian Board for Wildlife since its inception has also overwhelmingly consisted of members of this crust, with virtually no representative of local communities.
- Several PAs have been carved out of previously declared Reserved Forests (RFs). During the declaration of many of these RFs, especially during colonial times, the rights and needs of local people were dismissed by official diktat, even though actual dependence on the resources continued. In many cases, villagers were brought into forests and settled by the Forest Department to provide labour in forestry operations; these developed into full-fledged villages who were largely dependent on forest resources, and who were never moved back out after operations stopped. In both these cases, the resource uses were considered illegal, or 'improper', during declaration of the areas as PAs though of course pragmatic considerations forced the Forest Department to allow the continuation of many resource use activities.
- There was, and continues to be, an assumption that wildlife conservation and habitat management are the prerogative

of urban naturalists, formal ecologists, and foresters, and that modern biological science is all that was needed for the tasks. Even though it has become abundantly clear that socio-political factors are equally critical inputs in habitat conservation and management, and that traditional knowledge can play as vital a role as modern science, PA management remains heavily based on forestry and (to a lesser extent) on biological sciences.

Even in a conventional planning sense, there have been notable failures. India has had its fair share of naturalists and biologists of exceptional merit, both during and after the British period. Surely a person like Salim Ali ranks amongst the world's best wildlife experts, and there have been others like him. Unfortunately, however, even this available expertise has not been adequately used in the creation and management of national parks and sanctuaries in India. At times, the planning exercise has been highly irrational, creating situations of avoidable conflict.

Planning a PA network involves an assessment of areas and species which are critical for conservation, the major natural and human factors influencing or threatening them, and the conservation strategies and institutions needed. Conservation planning in India has been deficient in all these respects. Informally and sporadically, an assessment of areas and species which need conservation measures has been made by conservationists or state government officials, but no comprehensive national survey on this existed till the late 1980s. Recently, the Wildlife Institute of India conducted a pathbreaking study in identifying ecologically representative habitats which needed PA status,[37] but it was unable to look at the human factor in these areas. The IIPA PAs study which partly filled this lacuna, was conducted in the mid-1980s, but was largely based on governmental data, which can often be notoriously inaccurate. In any case, even this study has remained largely ignored in actual PA network planning.

Examples of irrational planning, and how this results in avoidable conflicts, are plentiful. As mentioned above, many PAs in the country contain human populations inside them; in many

cases, there is little possibility of shifting these people, even if this was socially acceptable, given the intense land pressures in surrounding areas and the lack of governmental resources. A number of these areas also have limited ecological value, with highly degraded ecosystems. The Bannerghatta National Park in Karnataka is an example. The Nargu Wildlife Sanctuary in Himachal Pradesh has 170 villages concentrated on the western side.[38] This side has little forest left; however, the eastern, more hilly side has wildlife value, and adjoins forests which for some administrative reason have not been included in the sanctuary. The daily conflicts which come up on the western side could easily have been avoided if the sanctuary boundaries had been based more on ecological grounds than on administrative considerations.

Other conflicts are created because of the irrational assignment of a particular PA category to an area. Under the WLPA, two categories of PAs are possible: national parks and sanctuaries. The former is by law more strictly protected, allowing virtually no human activity except that which can be defined to be in the interests of wildlife. In sanctuaries, there is scope for traditional resource-collection and land-based production activities, though this is left to the discretion of the wildlife and civic authorities. There are several examples of areas having been declared national parks with human populations inside, only to be followed by the park authorities tying themselves up into legal knots when they find that they cannot evict these populations. A current example is the controversy raging in the Nagarahole National Park in Karnataka. This park has 54 tribal settlements with a population of about 6000 inside, and for a long time now the Forest Department has been in two minds about whether to resettle them (as required by the WLPA). The tribals are naturally resisting displacement, stressing that they have a right to the area, and that they can in fact be central actors in its conservation. Again, the conflict could have been minimized if the inhabitated part of Nagarahole had been declared a sanctuary, or some other conservation category had been selected in consultation with the resident tribals.

Another well-known example illustrates that decisions about

PA status are often taken not only ignoring human factors, but are also often scientifically unsound. The Keoladeo National Park, better known all over the world as Bharatpur bird reserve, is a small wetland harbouring over 350 species of birds. It is partly artificial, filling up with the waters released from a nearby irrigation project. In 1980, its status as a sanctuary was upgraded to that of a national park, and almost immediately after, grazing was banned. In one of the worst incidents of conflict which followed, seven villagers were killed protesting against this ban. Ironically, a long-term study by the Bombay Natural History Society showed that buffalo grazing was an integral part of the ecosystem, helping to counter the tendency of the wetland to turn into a grassland.[39] Its ban had adversely affected the wetland. In desperation, park authorities have now had to allow grass-cutting by the villagers!

The decision to ban grazing was taken because it was assumed that grazing must be damaging the ecosystem, and because the WLPA does not allow grazing inside national parks. Similar assumptions are also made regarding other traditional resource uses, even though there is evidence that diversity may not be reduced by limited human activity, and may in fact be locally enhanced. This is the case with nomadic pastoralism in the African Savannah, traditional agro-forestry in Indonesia and hunting-gathering in the Amazon.[40] In India, scientists like P.S. Ramakrishna have found similar results for long cycle shifting cultivation in north-east India,[41] while ecologists working at the Indian Institute of Science and elsewhere have come to the same conclusion in their studies of seasonal grazing in the Himalayan pastures and hunting-gathering in the Western Ghats. They all warn, however, that such results are not generalizable to all uses and all ecosystems. Ironically, some conservationists who hold all local community activities to be inimical to PA conservation, are nevertheless willing to allow 'eco-tourism' into the same PAs!

A convoluted process in which the legal status, rather than conservation priorities and levels of human dependence, determines what human activity can and cannot be allowed, has created conflict in many areas. Thus in the core zone of the Manas Tiger Reserve, the Forest Department burns thatch grass

as a management measure, but does not allow local people to harvest it in a regulated manner for construction and fodder as that is not considered permissible in a national park.[42]

As shown above, decisions to restrict or stop certain human activities have often been taken arbitrarily, without any proper assessment of their impact on the ecosystem or its wildlife, and without any clear statement of the conservation objective sought to be achieved. Undoubtedly, most of these decisions are taken with the best of intentions. Undoubtedly also in many cases they are justified, for, as mentioned below, human pressures in several areas do cause serious damage. However, even in such cases, the lack of transparency and the high-handed manner in which restrictions are imposed, and the almost universal absence of suitable alternatives, has led to avoidable suffering and tension.

Over the years, a two-way conflict situation has developed, with PAs adversely affecting local people, and local communities becoming ecologically destructive.

Protected areas have had the following major impacts on people:

- Forced displacement from national parks, core zones of sanctuaries or special conservation areas like tiger reserves. Contrary to popular perception, the establishment of the Yellowstone National Park in USA, the forerunner to most such PAs in the world, also involved the forcible displacement of the Shoshone tribals.[43] For India too, this is not an entirely new phenomenon; the Maharaja of Kashmir, for instance, removed all human settlements from the Dachigam Deer Reserve (now National Park) in 1910.[44] Some commentators suggest that upwards of 600,000 people have been displaced from Indian PAs.[45] This may be an exaggeration, as it is based on the assumption that most people living inside national parks and core zones of sanctuaries have been evicted. An assessment of 104 human-inhabited PAs as part of the IIPA PAs study revealed that eviction had taken place in only 7, and was proposed for another 13, and that the number of people involved was a few thousand.[46] However, even these

relocations have been rather poorly carried out, though officials involved in some of them (e.g. the Kanha National Park in Madhya Pradesh) claim a high degree of success.

- The more common impact has been the curtailment or extinguishing of local community land and forest rights, or access to natural resources inside PAs. This has had a direct impact on their survival and livelihood base, for even basic inputs like cooking energy and fodder for livestock have become hard to obtain. Traditional activities have suddenly become "illegal", and villagers report considerable harassment and bribe-taking by forest staff. To add insult to injury, the reasons for this curtailment of rights have rarely been explained to villagers, and viable alternatives have rarely been provided.

  Recent (1991) amendments to the WLPA have further curtailed local community activities, by prohibiting all activities causing damage to the habitat of a sanctuary (a provision already in place for national parks). One immediate effect of this was that some state governments severely restricted or banned collection of non-timber forest produce from within PAs.
- The protection offered by PAs and the WLPA has resulted in an increase in the population of some species (elephants, wild boar, nilgai, tigers, lions, leopards, bears) in some areas. This results in a 'spill-over' of animals unable to find adequate food and territory, or of those who actually prefer human-made habitats like fields. In addition, people are no longer allowed to retaliate, as they may have done in the past; officials are especially harsh when villagers attempt to retaliate against threatened species. Finally, human intrusion into wildlife habitat has also increased manifold. The result of all these factors: direct human-animal encounters leading to human injury and death, livestock lifting, crop raiding, and property destruction. For example, about 63 (thirty per cent) of 206 PAs sample in the IIPA PAs study reported incidents of human injury or death. Crop damage by species like the wild boar and nilgai is so

widespread that some states have ordered their elimination from areas of high damage.

In this situation, a feeling of hostility amongst local communities has quite naturally built up. In an increasing number of areas this has manifested itself in the form of physical clashes between villagers and wildlife staff or other state forces, physical damage to habitats by irate villagers, poaching or support to outside poachers, and even demands for denotification. The discontent is often voiced in destructive ways, e.g. the widespread incidences of fire in several protected areas (the result of wilful neglect or even deliberate action); police firing upon villagers as in the Bharatpur case cited above; attacks on forest staff by angry villagers as in the case of the former Field Director of Ranthambhor Tiger Reserve who was nearly beaten to death. A survey of 222 PAs as part of the IIPA PAs study revealed as many as 47 which witnessed physical clashes between people (local or outsiders) and forest officials; Jaldapara Sanctuary in West Bengal reported twenty confrontations for the period 1979-84, while the Gir National Park in Gujarat, home to the world's last population of the Asiatic lion, reported twelve.

This conflict is one of the most serious threats faced by our protected areas and the biological and cultural diversity they contain. *A protection strategy which alienates local communities is unjust to them and disrespectful of their fundamental rights, as also short-sighted for wildlife conservation.* What is happening in Narayan Sarovar and Shoolpaneshwar—people demanding denotification—could well happen in many other Indian PAs. No amount of state control will save these habitats against such unrest.

The PA-people relationship is, of course, by no means one-sided. Increasingly local communities are putting excessive pressure on natural habitats, or becoming conduits to serve urban and commercial demands. The mass ritual hunting carried out by some communities (e.g. the "akhand shikar" of the Santhal tribals of Bihar) and the indiscriminate hunting of mammals and birds by some north-eastern tribes, are now causing irreversible decline in wildlife species. Even tribal

groups like the Naga Students' Association and the Naga Mothers Association have had to issue an appeal to stop hunting in the state of Nagaland; of special concern was the rapid decline of species like hornibills, whose casques are used as traditional headgear.

Ecologists have also pointed out that local resource use is no longer sustainable, because the population of the local community or that of their livestock has risen, or because their demands have gone up in response to urban consumerist values. Wildlife experts like Ulhas Karanth point out that over-hunting of herbivores by local people has led to severe shortage of prey for the tiger, forcing it out of reserves and into conflict with surrounding villagers. Another striking example of unsustainability is shifting cultivation in north-eastern India, as described earlier. Members of many tribes are involved in selling off forests, owned by tribals themselves, to sawmills mushrooming all over the north-east. In many parts of central and western India, the burning of forests for sal (*Shorea robusta*) seed and tendu leaf (*Diospyros melanoxylon*) collection, oriented for the market, has become so widespread as to cause serious ecological damage.

Wildlife habitats also face considerable encroachment. Out of 204 PAs studied in the IIPA PAs study, about 35 reported encroachments. This is a difficult issue to resolve. On the one hand, a lot of the encroachment is by poor people who have no alternative (since state governments have generally been unable to carry out adequate land reforms or provide the landless with adequate alternatives). On the other hand, commercial interests also encroach (see below, the example of Borivali), using poor people as fronts. More often than not, state governments have 'regularized' these encroachments, hoping to increase their vote banks or other 'earnings'. This was recently done, for example, in Madhya Pradesh. The Forest Conservation Act of 1980, which attempted to discourage such regularization, has been repeatedly violated in the process.

Even while wildlife conservationists and community rights advocates argue with each other, one of the major forces of destruction makes merry. This is the urban-industrial economy,

a sector which has no qualms about destroying biological or cultural diversity for short-term commercial gains. There are examples by the dozen in India, of mining, commercial fishing and forestry, dam construction, government office construction, road-building, tourism, and a variety of other commercial and 'developmental' activities inside national parks and sanctuaries. Many of these have come up after the establishment of PAs, e.g. prospecting in the Kudremukh National Park, mentioned above. The Madhya Pradesh state government has offered free landholdings to the tourism industry for setting up facilities inside Pench, Kanha, and Bandhavagarh National Parks, and Pachmarhi Sanctuary; mining threatens the Buxa Tiger Reserve in West Bengal; intensive aquaculture is spreading into the Pulicat Lake Sanctuary straddling Tamil Nadu and Andhra Pradesh. Commercial pressures on India's PAs are only going to increase manifold with the new liberalization and structural adjustment policies of the government. Exports of natural resources and related products, like fisheries, are a major thrust of these new policies, leading to excessive exploitation in forests, wetlands, and marine areas.

The extent to which state governments are willing to compromise to please the urban-industrial lobby is illustrated by the spate of denotifications carried out or proposed. Under the WLPA, any state government can take a PA off the record books, thereby removing its legal protection, by taking the permission of the state legislature. Obtaining such permission is usually not difficult, given that politicians are more concerned about votes (however illusory) than about wildlife. In 1991, the Darlaghat Sanctuary in Himachal Pradesh was denotified to make way for a cement factory. The Gujarat state government partially denotified Narayan Sarovar for cement production (at first, without even obtaining legislative approval, only getting it three years later when challenged in court!). It also threatened to denotify a part of the Marine National Park in the Gulf of Kutch to make way for an oil refinery. In the latter case, the brazenness of the corporate sector is astounding; in a company document, Reliance Industries openly asked for this denotification, stating that their foreign collaborator, C. Itoh, required it! In Orissa, the

government proposed denotification of the Balukhand Sanctuary to make way for a hotel complex, dropping the proposal only due to widespread protest. The same government has considered denotifying a part of the coastal Bhittarkanika Sanctuary. It claims that this is to enable the local small-scale fisherfolk to sell their catch better, but it is evident that it is to enable commercial trawling interests to operate off the coast. Government agencies other than the Forest Department also continue to occupy PA land for various non-conservation purposes. The IIPA PAs study found that 144 out of 233 PAs had such occupation; most common were roads, tourism facilities, and transmission lines.

What is often ignored is that *the root of many people-park conflicts lies in these urban-industrial pressures.* A classic case is that of the Rajaji National Park in the Himalyan foothills of Uttar Pradesh, the centre of a bitter conflict over the Forest Department's moves to evict the nomadic pastoralists or Gujjars. While the department and many conservationsists have focussed on the alleged overgrazing by the Gujjar's livestock, and local activists have hit back by pointing at the corruption rampant in the Forest Department, the truth is that the park's forests, wildlife (including elephants), and human inhabitants have been victim to the fragmentation of habitat caused by the expansion of the cities of Dehradun, Haridwar, and Rishikesh.[47] Traditional elephant migration routes have been cut off by industries, power channels, and army camps, increasing animal-human conflicts in the area where the elephants are now trapped. The Gujjars have become an easy scapegoat for the government, which is unable to control the urban-industrial expansion around the park. This is not to say that the impact of grazing and fodder-lopping can be ignored, but simply that deeper causes of degradation are not addressed. A focus on Gujjars is both unfair and narrow.

Vested interests also often use people-park conflicts as fronts to pursue their own agenda. Politicians are habitual exploiters of such situations, especially if they can see a potential vote bank in the aggrieved local communities. In the Sanjay Gandhi (Borivili) National Park outside Bombay, land developers regularly get poor people to encroach, project the issue as one of

the rights of slum-dwellers, and eventually take over the land themselves.

While criticism of the Forest Department for its high-handed handling of wildlife conservation programmes is justified, it is also necessary to point to the often heroic efforts of forest officials in saving threatened habitats and species. The odds are particularly heavily stacked against foresters, forest guards, and daily wage workers, whose working conditions are daunting. Apart from the physical rigours of working in natural habitats, there is minimal access to even basic facilities like transport, equipment, education, and housing; the salaries are low; and encounters with poachers and timber thieves who are usually better armed are frequent. News about forest staff being killed by the timber and poaching mafia are commonplace (I have myself witnessed with helpless horror the killing of a young official by wood thieves outside the Gir National Park); there is frequent harassment due to false charges levelled against them; very often they are up against powerful vested interests, or even people from other government departments, including the police.

In addition, the department has to work within the structure and directions set by the government. Since, even five decades after Independence, forest and wildlife conservation remains a low priority in state planning the Forest Department continues to have very little power and finances, compared to other government agencies that handle 'development' or commerce-related activities. The department is also dependent upon crucial support from other agencies, such as the Revenue Department and the police, but frequently does not receive it.

Finally, the training of forest staff in wildlife and habitat management has been abysmally poor. Though in the last few years this is being addressed, e.g. through the wildlife training at the Wildlife Institute of India, only a fraction of forest staff have been covered; to add insult to injury, many states often put wildlife trained officers into non-wildlife jobs such as forestry corporations!

In such an environment, the efforts of individual officers in opposing commercial interests is commendable. I have already

mentioned the case of the Radhanagari Sanctuary. A range officer in the Okhla Bird Sanctuary near New Delhi exposed the illegal granting of fishing contracts by the Delhi government, resisting offers of bribes and threats to life. With the help of local NGO support, he got the contracts cancelled. Just outside Corbett National Park, the Field Director caught a state minister fishing illegally, and fined him Rs 25,000 on the spot, risking possible transfer and harassment. Forest officers in charge of the Bhittarkanika Sanctuary in Orissa have consistently opposed their own state government's proposal for the construction of jetties there, one of them getting transferred as a result.

These are exceptional, but not isolated, examples of people fighting against the destruction of wildlife habitats from *within* a system which does little to encourage such boldness. Many social activists paint the entire Forest Department as corrupt or evil; this not only does these officers a grave injustice, but makes the task of bringing together all those interested in conservation even more difficult.

The increasing conflict in and around PAs has forced the government to respond in the last decade or so. Management planning has been substantially increased and upgraded. For local people, there have been improvements in relocation strategies, and increased provision of alternatives and jobs. International trends have once again influenced the process; e.g. the 1980 World Conservation Strategy proposed by the World Conservation Union, United Nations Environment Programme, and the World Wide Fund for Nature, has emphasized the importance of alleviating rural poverty as a component of conservation planning. From this emerged the concept of 'eco-development'. In 1982, a task force was set up under the Indian Board for Wildlife, to recommend measures to gain public support for conservation. It suggested that in "multiple-use surrounds" of strictly protected core areas, eco-development measures which could help to divert pressures from the PAs, should be taken up. In the late 1980s, interest in this picked up again, and in the mid-1990s, India negotiated a grant-cum-loan of 56 million dollars with the Global Environment Facility (GEF)

and the IDA, for eco-development around seven selected PAs.[48] Another 40 PAs may be targetted in the latter half of the 1990s.

Unfortunately, though recent eco-development proposals have been framed with a certain amount of NGO and local community consultation (a process earlier completely missing), they remain unwilling to tackle the root causes of conflicts in and around our PAs. For instance, the indicative eco-development plans for the selected PAs under the GEF project,[49] have virtually no proposal to revive community rights over land/water/forest resources, to reduce exclusive government control over these resources, or to redistribute such controls within stratified communities (except for suggestions like using some excess land of religious institutions to grow biomass for local people).

Many other shortcomings exist. Most eco-development plans continue to be targetted at people living *outside* PAs. While independent consulting agencies like the Indian Institute of Public Administration have not advocated the displacement of people living inside, they have also not stressed the need for eco-development planning for such people where they are currently residing. This leaves room for the Forest Department to continue to seek displacement (though ironically, the World Bank, which is disbursing the GEF funds, is insisting that no forced displacement take place and that plans be extended to populations inside the PAs too!). Secondly, state governments remain unconvinced about the need to involve people in PA management, even though independent consultants have stressed this. Third, local traditional knowledge continues to be neglected. Fourth, the legitimacy of a PA's legal status is rarely questioned, even though the status may have been decided in the arbitrary manner described above.

In an attempt to widen the scope of conservation strategies, UNESCO proposed the creation of Biosphere Reserves (BRs) in the early 1970s. These reserves were set up with the basic objective of conserving and developing a knowledge base about the biodiversity of a region, with the emphasis that humans were an integral part of the ecosystem and that local communities should be involved actively in conservation programmes.[50] This emphasis distinguishes it from national parks and sanctuaries,

and provides grounds for the reconciliation of conventional wildlife- human conflicts.

India has established seven BRs since 1979 (though none of them is officially registered with UNESCO): Nokrek (Meghalaya), Nilgiri (Tamil Nadu, Karnataka, and Kerala), Nanda Devi (Uttar Pradesh), Great Nicobar (Andaman and Nicobar Islands), Gulf of Mannar (Tamil Nadu), Manas (Assam), and Sundarbans (West Bengal). These cover about 21,067 sq. km. Another seven are proposed; together, these fourteen will be representative of the twelve major biogeographic zones of India.

However, actual management of these reserves continues to be based on the conventional PA approach, with the Forest Department in charge. Scientists of the Indian Institute of Science, in a survey of the seven Indian BRs, noted that there is virtually no attempt to reconcile development activities with conservation, to harness the knowledge of local communities, to involve such communities in management, or in other ways to achieve the objectives originally set for BRs by UNESCO.[51] In the case of the Nilgiri BR, for instance, the suggested restoration of a corridor through the Gudalur area in Tamil Nadu was never taken up, with the consequence that over the last decade this corridor has been destroyed by private encroachments and the activities of the Tamil Nadu Tea Corporation.

Clearly, the response to the people-park conflict will have to go beyond the eco-development approach, into one which places the local communities and their cultures squarely in the centre of the planning process. If properly implemented, Biosphere Reserves could be effective in some areas, especially where extensive areas need conservation. In the Sundarbans Biosphere Reserve, a start has been made by forming village Forest Protection Committees, under which local communities are empowered to protect areas for their own use, and promised 25 per cent of the profits realized from any exploitation that may be taken up later.[52] NGOs working with tribals in the Nilgiri BR have started making proposals for people's participation which could ensure the protection of biological and cultural diversity. But it is also clear that no one solution is likely to be relevant for the whole county. In many areas local communities have shown

that they can *on their own* protect wildlife habitats, though typically these are small in scale, such as the sacred groves scattered through much of India. Many other areas, large-scale and remote from human habitation, are probably best managed by the government with some independent NGO and research support. But increasingly, it seems clear that neither local communities nor government agencies *on their own* will be able to conserve PAs and wildlife. Communities lack the resources to tackle threats or ecological issues at a regional scale, and in many places have lost their traditional ethos and institutions; government agencies lack the necessary micro-knowledge, on-the-spot humanpower, or even often the necessary mandate when other agencies overrule them. With rare exceptions, neither the local community nor the Forest Department on its own is able to face the onslaught of commercial forces, or able to check the destruction caused by some of their own members. *There is therefore a need to explore partnerships in conservation, which will involve local communities and government agencies as core, equal participants, with support from NGOs and independent researchers.*

The need for such a partnership is now felt all over the tropics, where so far a top-down approach has been practised. The Caracas Declaration, made by 1500 delegates from around the world at the IVth World Congress on National Parks and Protected Areas in Venezuela, February 1992, urged all governments and appropriate national and international bodies:

> to support the development of national protected area policies which are sensitive to customs and traditions, safeguard the interests of indigenous people, take full account of the roles and interests of both men and women, and respect the interests of children of this and future generations;...
>
> To develop mechanisms that will allow all sectors of society, especially long-standing local populations, to be partners in the planning, establishment, and management of protected areas, and will ensure they share equitably in the associated costs and benefits;...

The recently signed Convention on Biological Diversity also commits countries to such actions, specifically seeking the encouragement of traditional activities which are relevant to conservation, and a sharing of benefits with local communities (see Chapter 6 for further details).

In India the debate is beginning to focus on the need to give local communities the necessary powers, responsibilities, and rights that would empower them to be partners in conservation. A move is gaining ground to bring in some form of Joint Protected Area Management (JPAM), which I would define as:

> "the conceptualization, planning, and management of protected areas and their surrounds, with the objective of conserving natural ecosystems and their wildlife, while ensuring the livelihood security of local traditional communities, through mechanisms which ensure a partnership between these communities, government agencies, and other concerned parties."

Though this is a relatively new concept in India, elements of cooperation between various stakeholders already exist in several places in India (including the examples of Kailadevi, and Sariska given above). Lessons from these and other experiences can be distilled into a rough blueprint for joint management, given in Appendix 6.

Some conservationists fear that JPAM would mean an opening up of all PAs to human use, and that no part of the country will be left 'inviolate'. On the contrary, it has been argued that a participatory exercise which examines all areas currently uninhabited and unused, as also all areas that communities are willing to leave alone, could yield much more than the 1 per cent land currently 'closed off', and would mean much more effective protection.[54] *No additional area, not already under traditional use, must be opened up to human use.* Rather, even areas outside PAs which are currently not in use by local communities (but which may be under governmental or commercial use), should become inviolate PAs if considered valuable enough. It is, of course, critical that tourism also be banned in such areas, for to do otherwise would be hypocritical.

Indeed, with the suggestions made above for an expansion of the categories of PAs, I believe that a much greater proportion of India's territory could come under conservation-oriented management. There is no reason why the country cannot reach a PA coverage of 10 per cent, as advocated by the World Conservation Strategy, if this is felt to be desirable.

Several obstacles and opportunities present themselves on the way to this new path of conservation.[55] Perhaps the most critical stumbling block will be the intense distrust and mutual suspicion between the Forest Department and local communities. The only way to change this would be for the two parties to sit and talk in an open and equal way, perhaps with the intervention of NGOs and concerned individuals. For instance, the Indian People's Tribunal on Environment and Human Rights (IPT), a network of NGOs and individuals, has initiated such an effort in the controversy- ridden Rajaji National Park in north India. It has asked a retired senior judge to investigate the matter, and mediate between the parties concerned. In many areas the ice is being broken by forest officials or NGOs (e.g. Kaila Devi Sanctuary, where a sensitive Divisional Forest Officer struck up a mutually beneficial relationship with local pastoralists).

However, even where there may be a willingness to consult and negotiate, there are severe limitations to people's involvement imposed by existing wildlife laws. *The WLPA allows very limited scope for local people's involvement in management, and for deriving benefits from PAs.* The 1991 amendment to the WLPA took an important step in opening up the possibility of villagers' rights continuing inside a sanctuary, though not yet for national parks, and though still subject to the discretion of the government. It also went a weak step towards obtaining public involvement, by stipulating the participation of tribals in the State Wildlife Advisory Board, and granting citizens the power within the act to prosecute offenders.

Clearly, there is a need to add further clauses to the WLPA, with mandatory involvement of local traditional communities in the planning and management of PAs, and more flexible clauses regarding rights and activities which are to be carried out in each category of PA. There is also a need to relate the WLPA with the

recent Panchayat Raj legislation, in which considerable powers are being devolved to village representative bodies (though rather unsatisfactorily, especially in the case of tribal areas).

Several existing efforts have important lessons to teach. The widespread experiments with Joint Forest Management (JFM) in several states of India, are now being examined for their relevance to PAs, with the caveat that PAs are essentially conservation units whereas other forests currently under JFM are extraction units. Then there are innumerable community efforts, such as ancient sacred groves all over India, village protected forests declared in parts of Orissa, Nagaland, and other states, peoples PAs such as the Bhairodev Dakav Sonchuri (mentioned above), the experiences of which would be valuable to learn from. The network of Biosphere Reserves could be oriented towards joint management, as has happened in many other countries, and as is being partially tried out in the Sundarbans BR in West Bengal.

In several countries of South America and Africa, participatory management is reportedly being successfully tried out.[56] For instance, the Uganda National Parks Authority has entered into a 'collaborative management' contract with local tribals at the Bwindi National Park, and is considering extending it to all PAs. In Australia, aboriginals are co-managing some PAs. In Zimbabwe, the CAMPFIRE project has involved communities in conserving and sustainably using large rangelands. In the Honduras, cultural preservation areas along with biological reserves are being created so that tribal people are able to maintain their traditional ways of life. Even some of India's neighbouring states are trying local community participation, e.g. at Karakoram in Pakistan, and Annapurna in Nepal. Though not all these examples are appropriate to the Indian situation (e.g. CAMPFIRE involves the hunting of large herbivores, which would be unacceptable here), there is much that we can learn from many of them.[57]

One major challenge facing JPAM is to define the local community itself, especially in situations of severe local stratification (caste, class, religion), or in cases of populations which have recently moved into an area. Giving benefits to the

poor first is crucial, but other sections cannot be ignored. There is also the question of how one defines 'traditional', and whether 'traditional' rights can be terminated once community members opt for 'modern' lifestyles? If we as urban dwellers cannot have the right to extract resources from, or live inside, a PA, perhaps the same yardstick could apply to members of the community who aspire to urban lifestyles? These are tricky issues, but even their long-term resolution needs a fully consultative process rather than official diktat.

Another constraint is the lack of adequate or accurate information on ecological and social aspects related to PAs, and a tendency among government and research organizations to keep information hidden from each other and from the public. There is, therefore, an urgent need for free flow of information between all people interested in PA conservation, for complete transparency in decision-making, for greater ecological research, and for respecting and using traditional knowledge on par with modern knowledge.

A FINAL WORD

This chapter has given an overview of the alarming situation with regard to wild biodiversity in India, and has focused on one of the most important national measures to protect it, the creation of protected areas. There are, clearly, very many other issues which need attention, including the need to focus on 'lesser' animals (amphibians, fish, insects) and plants (ferns, grasses, fungi), the problems and prospects of *ex-situ* conservation (in zoos and botanical gardens), and the need to counter the renewed explosion of hunting and trade in threatened species (suddenly, the tiger is back in the limelight, as reports pour in of dozens being killed every year, to feed the flourishing trade in its parts in eastern Asia). However, I believe that the general principles advocated above, especially the need for much greater public participation and the re-empowerment of people, and the need to curb rapacious industrial-commercial forces by forging an alliance between mass movements and

conservationists, are as valid for these issues as they are for protected areas. Without local community support, the tiger cannot be saved, regardless of the innumerable strike forces and committees that the government may set up.

At another level, it has been argued by many that there has been too great a focus on protected areas, and that considerable biodiversity exists outside of these areas, including in human-dominated landscapes which contain a mosaic of forests, pastures, agricultural lands, and wetlands. This argument is completely justified, and I have no hesitation in supporting a plea to give far more attention to non-PA areas than is presently the case. Indeed, this would only further reinforce the need to bring community participation into the centre-stage of conservation, for it is local people who are managing, or have the knowledge regarding, a substantial proportion of these areas. In the case of forests, there has been considerably widespread and illuminating debate on the integration of these concerns into a new forest act, resulting in a draft Peoples' Forest Bill which NGOs have put to the government in late 1995. For rural India as a whole, a draft bill on natural resource management, which centres on community control, has been presented after a series of consultations.[58]

These are all important elements of an overall solution to the vexed issue of wild biodiversity loss. My focus on protected areas above has therefore been due only to my own limited experience, and is not meant to belittle the need to highlight areas outside of the PA network, or other aspects of wildlife conservation.

3

Domesticated Biodiversity

Discussions on biodiversity generally tend to be restricted to wildlife. This bias perhaps stems from the western concept that humans are outside of nature, that biodiversity has essentially to do with "wilderness", and that the human impact on the biological world is necessarily negative. However, this ignores an entire spectrum of life forms which finds its origin, and/or development, in human-influenced ecosystems. I refer here to the diversity of crops and livestock (including poultry) found on agricultural fields and pasturelands. Worldwide, farmers and pastoralists have selected, bred, and maintained several species of plants and animals, and have developed within these species an incredible genetic diversity.

Of the estimated 250,000 species of flowering plants, about 3000 have been used for food purposes through human history; of these, only about 200 have been domesticated (cultivated); and of these, just 15 to 20 are crops of significant economic importance. The vast majority of these have originated in the tropics and the mid-eastern region. Based on the work of Russian botanist N.I. Vavilov, scientists recognize eight major regions of crop diversity: the Meso-American, the North Andean, the Mediterranean, the Near Eastern, the Central Asian, the Indian, the South-East Asian, and the Chinese.[1]

Like many large tropical countries, India is characterized by a complex mosaic of distinct agro-ecosystems, differentiated by their climatic, soil, geological, vegetational, crop-growing, and other features. A recent classification by the National Bureau of

Soil Survey and Land Use Planning distinguishes 20 broad agro-ecological zones, separated by natural features and crop growing periods.[2] Each of these agro-ecological zones in turn comprises myriad micro-habitats. It is within this diversity of habitats that an amazing variety of crops and livestock has been developed over the millenia, by Indian farmers.

As mentioned above, the Indian region is one of the world's eight centres of crop plant origin. According to Dr. R.S. Rana, former director of the National Bureau of Plant Genetic Resources, at least 166 food/crop species and 320 wild relatives of crops have originated here (though many of them also have their origins or centre of diversity in other regions). These include rice, pigeonpea, turmeric, ginger, pepper, banana, bitter gourd, brinjal, okra, coconut, cardamom, jackfruit, sugarcane, bamboo, taro, indigo, sunhemp, amaranthus, mango, and gooseberries. Species which may have originated exclusively in India include mango, taro, cucumber, pigeonpea, pepper, eggplant, and cardamom.

While the species diversity among Indian crops is significant, what is truly mind-boggling is the genetic diversity within each of these species (see Appendix 2). To give some examples, one species of rice (*Oryza sativa*) has been diversified into at least 50,000 distinct varieties; some scientists believe the figure may be closer to 200,000! One species of mango (*Mangifera indica*) has yielded over 1000 varieties, ranging from the size of a peanut to a musk melon; a similar figure is estimated in the case of taro (*Colocasia esculenta*). Other crops with rich diversity in India include wheat, sugarcane, legumes, sesame, okra, eggplant, banana, jackfruit, jamun, jute, ginger, turmeric, pepper, cinnamon, cardamom, sweet potato, yam, kidney beans, velvet bean, and the coconut.

India also has amongst the world's largest diversity of domesticated animals, with some 26 breeds of cattle, 40 of sheep, 20 of goats, 8 of camels, 6 of horses, and 18 of poultry,[3] apart from the yak, the mithun, and several species and breeds of birds including geese, ducks, pigeons, and doves (see Appendix 2). It is noteworthy that the characterization of Indian livestock breeds was last done in the first half of this century; since no recent

estimates are available, and surveys in some regions are far from complete, some scientists feel that the diversity may be even greater.

WHY THIS DIVERSITY?

Over centuries, Indian farmers have continuously adapted and modified the rich genetic material available to them from nature. The diversity of crops and livestock is not just accidental, nor is it purely natural; it is more the outcome of thousands of years of deliberate selection, planned exposure to a range of natural conditions, field-level cross-breeding, and other manipulations which farmers have tried out. In other words, a single species of rice collected from the wild, some time in the distant past, has diversified into 50,000 varieties as a result of a combination of evolutionary/habitat influences and the ingenuity and innovative skills of farming communities. This latter contribution to genetic diversity is a fact that the modern seed industry always conveniently sidesteps, and that the non-discerning consumer is ignorant of.

But why in the first place did farmers do this? One obvious answer is that different crop varieties and livestock breeds were adapted to diverse local conditions of growth and survival that were available in the country. This process continues. Livestock scientists recently found that migratory pastoralists in Rajasthan had selected for, and helped develop, a new breed of sheep, called *dheri*, in response to the increasing drought incidence and declining pasture availability.[4]

Adaption to localized environments has been only one mechanism or reason for diversification. What is even more striking is the use of a large diversity of the same crop within a single village, and sometimes within the same field. Many tribal villages in the hills of north-east India have been known to grow over 20 rice varieties within a single year in their terraced fields. One recently sampled village in the state of Nagaland was found to have 70 varieties! In one region of Koraput district of Orissa alone, scientists identified over 1500 varieties.

Within a single village, domesticated diversity can be spread over time (seasonal) and space (geographical), over vertical and horizontal layers within the same field, and within and between species. Many traditional communities practised a form of agroforestry which combined trees with crops and animal husbandry. In the high-rainfall areas of Kerala and Meghalaya, tribal communities maintained tiny home gardens which gave them wood, medicinal plants, spices, and ornamentals, apart from food. Even the much-maligned systems of shifting cultivation (*jhum*) in north-east India encouraged the use of a large diversity of crops. Ecologist P.S. Ramakrishnan, well-known for his pioneering studies on *jhum*, recorded upto 35 crop species in a single cultivation cycle.[5]

More than mere physical adaptation, a host of economic, cultural, religious, and survival factors have played a role in this diversification. For instance, scientist W. Perreira notes, amongst the Warli tribals of Maharashtra, a great diversity of rice grown for different water and soil needs, varying maturity periods, resistance to different diseases, and various cultural events.[6] Several varieties of rice and other crops were grown in many parts of India just for their use during festivals, marriages, or other auspicious occasions; several others were grown for their taste, colour, or smell; yet others for their pesticidal or soil-fertilization characteristics. Diversification also provided buffer food output in times of drought, flood, or pest attack, when the main crop might fail.

The stability of a biodiverse agriculture is perhaps its most important characteristic, as recorded from many parts of the world.[7] This is wonderfully illustrated by a once-common practice in the Garhwal Himalayas, the *baranaja*. Literally meaning '12 grains', this practice involves the sowing of a mixture of crops into a single plot of land. *Rajma* (kidney beans), *urad* (black gram), *mung* (green gram), *kulth* (horsegram), *marsha* (amaranthus), *mandua* (finger millet), *jhangora* (barnyard millet), and other crops are grown in a jumbled profusion which to a modern agricultural scientist would appear a mess, but which is actually a carefully considered way of obtaining optimal and sustained yields. Since the maturity periods of these crops vary,

different crops are harvested at different times, helping to retain soil moisture, and providing a constant supply of food. Fertility is continuously recharged by the use of leguminous plants like pulses. In addition, bunds along the fields support trees like *bhimal* (*Grewia* spp.), used for making rope, soap, baskets, and for fodder. According to some assessments, *baranaja* gives a higher overall productivity (apart from meeting diverse needs) than if the field was to be converted into a soyabean monoculture, which is being propagated by official agricultural agencies in the region.[8]

THREATS AND DESTRUCTION

As is well-documented, the land and taxation policies of the colonial government were responsible in the early part of this century, for the disruption of local agricultural systems.[9] But even more dramatic changes in Indian agriculture have come in the last few decades. With the advent of the Green Revolution in the mid-1960s, a handful of laboratory generated varieties have been promoted over vast areas, particularly in the plains of northern India. Given certain inputs such as irrigation and chemical fertilisers and pesticides, these varieties produce high yields (thus the somewhat misleading term High Yielding Varieties, or HYVs). It is understandable for farmers who can afford such inputs, or who are offered related bank loans, to take enthusiastically to these varieties. Agricultural schemes have also attempted to homogenize growing conditions, for example by surface irrigation, so that where there was earlier a complex mosaic of diverse micro-habitats, you now find immense stretches of uniform agricultural landscape. Inter-cropping is replaced by monocropping, a wide diversity of species is replaced by a handful of profitable ones, and genetic diversity within the same crop species is replaced by a narrow genetic range of financially lucrative varieties. The net effect of these and other practices has been a massive displacement of indigenous crop diversity, so much so that in the case of most crops now, the majority of indigenous cultivars are no longer grown.

There is no available figure for the overall loss of crop diversity in India, as indeed for the world. Some idea can be gauged by the fact that a handful of HYVs are now grown over 70 per cent of the paddy land and 90 per cent of the wheat land of the country. Thousands of varieties of cereals (rice, wheat, etc.), cotton, minor millets, pulses, and other crops are no longer in use on farms.

Livestock diversity has also faced a serious threat. It is estimated that 10 (50 per cent)) of the goat breeds, five (almost 20 per cent) of the cattle breeds, 12 (30 per cent) of the sheep breeds, and all the 18 breeds of poultry, are today threatened.[10] According to D.S. Balain, former head of the National Bureau of Animal Genetic Resources, the Ongole breed of cattle has already been lost to India, and is reportedly now found only in Brazil where it was imported from India! The Kadaknath breed of hen has almost been pushed to extinction (see Balain and Nivsarkar 1991), as have the Bonpalo and Nilgiri breeds of sheep.[11]

The greatest factor in the loss of domesticated animal diversity has been deliberate cross-breeding with exotics, carried out extensively by the government in order to increase the yields of milk or other animal products. Semen banks have generally stored the semen of exotics. While all kinds of livestock are affected, perhaps the worst off is poultry; exotics now make up 80 per cent of the total poultry population, with disastrous effects on indigenous breeds. The current thrust towards export-oriented poultry production, and the entry of fast-food chains like Kentucky Fried Chicken, which prefer exotic poultry varieties, is likely to intensify the loss.

Other factors which have caused an erosion in agricultural biodiversity include the destruction or conversion of habitats to which breeds or varieties were specially adapted, and the disruption of traditional lifestyles, through urban migration and displacement by development projects. Genetic diversity of cultivated species of plants, especially cereal crops, pulses, vegetables, and the plants used for religious and social purposes, have been threatened by changing social and religious norms, and cultivation methods. Intense grazing activity by cattle has depleted wild cereal grasses, which are vital sources of genes for

the improvement of existing crops. The clearing, in modern agricultural practice, of bounds and hedgerows, which once served as respositories of genetic diversity of crop and animal species, has also taken its toll. Finally, but certainly not least in importance, the subtle (and not-so-subtle) changes in food habits have been a major cause of genetic erosion: everywhere, people have been brainwashed into believing that wheat and rice are the only two cereals worth eating. As perceptively pointed out by Dr. P.V. Satheesh of the Deccan Development Society, the ration shops of the public distribution system do not stock any of the coarse grains, only rice and wheat. Not only do people have to buy these for consumption, but farmers do not have the incentive to grow their traditional crops since there is no guaranteed buyer. The end result: a handful of varieties of wheat and rice, have replaced many local cereals like *jowar* and *bajra* and *ramdana*.

This erosion of agricultural biodiversity threatens the long-term stability and sustainability of Indian agriculture itself, in many ways:

- It erodes the genetic base on which scientists are dependent for the continuous improvement of crops and livestock. The majority of HYVs themselves have been developed from genetic material taken from traditional varieties and wild relatives of crops. These HYVs, in particular hybrids, are not very long-living: they tend to lose their viability and productivity, or become increasingly susceptible to pest/disease attacks, within a few years. This necessitates the infusion of fresh genetic material, which is again obtained from existing traditional varieties or from wild plants. But then the introduction of these HYVs is itself a major cause of the erosion of traditional crop diversity. Some of this diversity can be stored in gene banks and accessed when needed (see below), but there is an inevitable loss even in such storage, and the continuous evolution of new varieties which was taking place on the farm is no longer happening. As has been said, modern agriculturists are somewhat like masons building the roof of a house by taking the bricks from the walls!

- The failure of a single HYV crop due to any natural calamity is a crippling blow for a farmer who has no other crop to fall back on, unlike traditional agriculture where some fall-back crops were also grown. Some degree of security against such eventualities can be artificially achieved by measures like protective irrigation, subsidies, and credit schemes, but such measures are expensive and prone to failure. For the country as a whole too, the increasing reliance on a narrow genetic range of crops represents a high-risk proposition.
- Both features above result in an increasing dependence of the farmer on the industry-dominated market and government. Virtually everything that is required for farming, except land and family labour, is now obtained from outside the village: seeds, irrigation, fertilisers, pesticides, credit. And despite huge subsidies on these inputs, as also support prices and the like, an increasing number of farmers are facing the economic treadmill, spending more and more to achieve the same output. Some commentators have observed that at least part of the unrest in places like Punjab and eastern Uttar Pradesh is because of the frustration of farmers trapped by the short-term lure of the Green Revolution.[12]
- Several other effects of modern farming have brought insecurity to the lives of farmers. For instance, the traditional paddy field in north-eastern, south-western, and central India provided not only rice but also fish, frogs, and other elements of biodiversity which were an important part of the diet of several communities, especially tribals. Modern paddy fields, which require large amounts of chemical fertilisers and pesticides, are devoid of much of this biodiversity, with a resultant loss of nutrition for farmers. Similarly, in the Western Ghats, e.g. of Kerala, farmers grew a profuse mix of fruit trees and food crops on slopes, along with paddy in the valleys; the former is now increasingly being replaced by plantations of single cash crops like tea, so that there is a heavy dependence on the market for food requirements.

Dr. R.H. Richaria, one of India's most eminent rice scientists, put it thus:

> "The traditional agricultural systems and sciences as practised in India and South-East Asia have been, to a great deal subverted in the past 25 years. The rice farmer who has a proud history of plant breeding and scientific eco-specific cultivation is today turned into a cog in the wheel of the agricultural 'sector' where his fund of knowledge is considered only as 'tradition'. The tremendous onslaught of western ideas and approaches and the devaluation of farmers' own knowledge and wisdom have most critically affected the marginal and small farmers who form the backbone of our agriculture."[13]

In a related trend, the move towards more and more high-technology agriculture makes the country as a whole also more insecure, as it increases its dependence on biotechnologies controlled by industrial countries and multinational corporations. The entry of Cargill, Ciba-Geigy, and other globally powerful companies into India's seed sector is the first step towards this crippling dependence, and a direct reversal of policies which had all this while tried to take us towards self-reliance.

The frightening implications of the erosion of domesticated diversity are only now dawning on the agricultural establishment, though they have been apparent for years to a large number of community organizations and independent observers. Worldwide, there is a scurry to retrieve the situation; the Food and Agricultural Organization of the United Nations called a global conference on plant genetic resources in mid-1996, where possible corrective measures at international and national levels were discussed. A series of meetings within India too have been organized, including on crop diversity conservation and on-farm conservation of livestock breeds, topics which would have been taboo for the government just a few years ago.

OPPORTUNITIES FOR CONSERVATION

A considerable amount of the genetic material which has been grown or bred by farmers may no longer be available in the field, but has been collected and stored in gene banks and breeding stations. The National Bureau of Plant Genetic Resources and the Indian Council of Agricultural Research, in their network of gene banks, have several hundred thousand accessions. Such *ex-situ* collections are important, as they are able to store material which may no longer be possible to grow in the field, and as they make available the base material for genetic upgradation of agriculture.

But such collections also suffer from severe limitations: they are very expensive, lack adequate space to store the complete genetic diversity found in agriculture, and suffer loss of viability of stored germplasm. They also freeze evolution, since the environmental conditions which crops are constantly adapting to cannot be recreated in the icy ambiance of the gene bank. Finally, they have various political problems associated with them, especially the difficulties of farmers having access to them and, conversely, of regulating commercial access to their collections (discussed in greater detail in the next chapter).

For this and other reasons cited above, there is no alternative to the conservation and continued use of crop and livestock diversity *in situ*, i.e. on the farmers' fields and the pastoralists' rangelands. Unfortunately this aspect has been almost completely ignored in governmental programmes, with the exception of some efforts to encourage the continued use of traditional livestock breeds (see below). However, *in situ* conservation of crops is finding increasing attention in the work of community organizations and NGOs. Farmers in many regions are beginning to compare their indigenous biodiverse forms of agriculture with the modern monocultures, and at least some of them are coming to the answer that a revival of the former is preferable to running on the economic treadmill of the latter.

Actually, a revival or development of a biologically diverse agriculture is eminently possible in India, because the

destruction of traditional diversity has not yet become irreversible. Consider the following facts:

1. The Green Revolution technology has not spread to many parts of the country, for several reasons, including its exhorbitant costs, and lack of appropriate packages for so-called 'marginal' areas (mountains, flood-prone areas, arid zones). This means that a lot of traditional agriculture still survives, retaining with it considerable diversity of crops and livestock, and the knowledge and practices associated with them.
2. Even where new HYV crops and cross-bred or exotic livestock breeds have been introduced, in many areas they have failed to produce the necessary results, or have not performed to the satisfaction of farmers. This is especially true of 'marginal' areas. In many cases, therefore, farmers have reverted back to their indigenous varieties, or continue to grow these varieties along with the HYV ones, as insurance against the failure of the latter.
3. There is a certain resilience to change (what agricultural scientists prefer to call "stubbornness" or "backward mentality") amongst Indian farmers, which has helped to retain elements of traditional diversity and practices even in areas where the Green Revolution has been aggressively pushed.
4. Related to the second point above, but qualitatively different, is the tendency for many farmers to grow HYVs for the market, but their traditional varieties for home consumption. Agricultural planners would call this "double standards", but the farmer is simply combining the possibilities of earning good renumeration (made possible not by any inherent characteristic of HYVs, but by an economic system which subsidizes and favours these HYVs), with the personal desire to eat healthy food. Again, considerable on-farm diversity may exist because of this.

But apart from the above, most exciting is the deliberate attempt by groups and individual farmers to revive agricultural diversity. This revival could be because of economic,

environmental, spiritual, or other reasons, and is taking root in many parts of India.

In the Hemval Ghati of the Garhwal Himalaya, some farmers under the banner of the Beej Bachao Andolan (Save the Seeds Movement), have initiated a quiet revolution. A few of the movement's members, like Vijay Jardhari and Raghu Jardhari, both small farmers, have been travelling in the region collecting seeds of a large diversity of crops. Though the area has largely taken to HYV paddy cultivation, they report that many farmers still grow indigenous crops in small plots adjacent to the commercial varieties. For the last few years, Vijayji is trying out these indigenous seeds in experimental plots over about two acres: in all, he has tried about 130 varieties of rice, 110 varieties of kidney beans, 40 of finger millets, 8 of wheat, and a diversity of other crops and tree species.

Vijayji maintains meticulous records of the varieties he grows, as also of whatever information he can get from other farmers in the region who are using indigenous varieties. He has a herbarium with over 120 cultivars of rice, giving details of local names, growing period, grain colour, and other characteristics of each variety: thapachini (tall, high-yielding, non-lodging), nagni basmati (red and white grains, nice aroma), gorakhpuri (fast-growing), chowari (red grain, high-altitude tolerant, starchy), bangooi (black-stemmed, used every three years so that weeds stand out in contrast and can be removed).

Nor have these farmers restricted their activities to their own fields for they are actively encouraging other farmers in their villages to adopt some of the traditional seeds which they have found useful for some characteristic or the other. Initially they met with resistance, since farmers using HYVs were not confident that traditional varieties would earn them a similar livelihood. However, some farmers who had begun to feel the pinch of the economic treadmill, or who were conscious of the health and ecological implications of using chemicals, did take the advice. On a visit to Vijayji's village, Jardhar, I met some farmers whom he had influenced. They told me that they were in the process of completely switching back to organic farming with some of the indigenous paddy and other crop varieties, and

expected to be economically much the better off for it, since they could now forego expensive chemical and seed inputs. They pointed out that some of the traditional paddy varieties, like thapachini, performed as well as HYVs, needed less inputs, and produced more fodder material. Interestingly, Vijayji and other farmers in the village also pointed out wildlife which lived on their organic fields: spiders, frogs, butterflies, earthworms. They were conscious of the fact that some of these animals helped to control pest populations, or to maintain soil fertility, and that they did not survive in chemical-intensive farming.

Other members of the Beej Bachao Andolan, like Saab Singh of Lasiyal village, Dhoom Singh Negi of Khadi village, and Bhupal Singh Krishal of Nahin-Kalan village, are now attempting to spread biodiverse organic farming in their regions, and report results similar to Vijayji's. Though their influence in the region is as yet miniscule, it is growing, and the movement has no doubt that as more and more farmers realize the treadmill that the Green Revolution has trapped them into, they will turn to a revival of biodiverse farming.

The Beej Bachao Andolan is just one of the dozens of networks and organizations, and perhaps tens of thousands of farmers, who are rediscovering the value of biologically diverse agriculture. Some names and addresses are given in Appendix 3. Navdanya is a large network of farmers, environmentalists, scientists, and concerned individuals which is working in different parts of India to collect and store indigenous crop varieties, evaluate and select those with good performance, and encourage their reuse in fields. It has also produced a series of useful readers on the issue.[14] Then there is the Academy of Development Science and the Indian Society for Rural Gene Banks, working with farmers in Maharashtra to document their rice diversity, set up community gene banks (currently holding over 300 rice varieties from western India), and propagate selected varieties. Some of these varieties have been reported by these groups to be as high-yielding as the modern HYVs. In a highly eroded region of Andhra Pradesh, the Timbuktu Collective is trying out organic farming and has started a grain bank of indigenous crop varieties. Also in Andhra Pradesh, the

Deccan Development Society is working with tribals to revive crop diversity. At Melkote, a historic temple town in Karnataka, a veteran Gandhian is experimenting with organic farming and indigenous varieties with the help of physically handicapped children and mentally disturbed adults. There are thousands of other such groups, individual farmers, and networks, who are doing similar work in various parts of India.

Other exciting innovations are taking place in the field of marketing of biodiverse produce. As in the West, consumers in India too are increasingly getting worried about the poisons they are eating in their daily diet; indeed, recent research shows that a substantial proportion of the foodstuffs in the market in cities like Delhi have pesticide residues which are above the recommended safety limit. Widespread publicity about this is converting the discerning consumer into a person who would prefer to buy organic food, if only he/she could. A small survey in the early 1990s in Delhi revealed that people from diverse backgrounds were keen to get such food, and many were even willing to pay a slightly higher price than its chemically-impregnated equivalent; the survey also revealed a number of outlets, who were willing to stock and separately display organic food.

As a small step towards this, groups in Delhi, Bombay, Bangalore, Pune and other cities have set up direct links with farmers who are growing food organically. Some of these networks are also encouraging farmers to grow their indigenous varieties, which in any case often do better than new HYVs under organic growing conditions. The environmental action group Kalpavriksh, for instance, has linked up with the Beej Bachao Andolan members, and is helping to market some of the traditional varieties of kidney beans, rice, and other crops in Delhi. It is also helping the villagers to document their range of practices related to biological resources in what is called a community register (more on that in the next chapter), and to revive some traditional uses of trees and fruits, such as soap-making from *bhimal* (*Grewia* spp.), oil and bath-scrub production from wild apricot, and others, for both domestic consumption and sale outside.

The necessity of *in situ* conservation of crop and livestock diversity has finally come home to the government too. The National Bureau of Animal Genetic Resources (NBAGR), the central agency dealing with livestock diversity, has of late initiated some schemes to encourage farmers and pastoralists to continue or revive their use of indigenous breeds. The National Bureau of Plant Genetic Resources (NBPGR), the NBAGR's crop counterpart, is also exploring possible schemes to encourage on-farm conservation of crop diversity. Its former director Dr. R.S. Rana had also expressed interest in taking a part of the vast seed collection in the NBPGR gene bank back to villages where farmers may be willing to diversify their cropping. A comprehensive action plan and a legislation on biodiversity, being formulated at the Union Ministry for Environment and Forests as a follow-up to the Convention on Biological Diversity, also propose to include measures to check the erosion of agricultural diversity.

But by and large, the thrust of official agricultural research and development continues to be towards extensive monocultures, chemical use, and expensive inputs from sources outside the farming community. It is quite clear that unless India's agricultural policy changes drastically, biodiversity and farmers' self-reliance will continue to be eroded.

IMPLICATIONS FOR AGRICULTURAL POLICY

The biggest question obviously is: can we feed a growing population with organic, biologically diverse agriculture? Alternatively, can farmers be given livelihood security through diversity? The examples mentioned above, as also many others in India, seem to indicate that there is great potential to increase and sustain food production through a mix of strategies based on the revival of diversity. This relates not only to the use of traditional varieties which have shown high productivity, and of new varieties which build upon these without displacing them, but also to the use of agricultural systems which mix grain, fruit, nut, animal, and other sources of nutrition rather than

concentrate only on grain production. Thus the rice and fish production system of the Apa Tanis of Arunachal Pradesh in north-east India, or the *baranaja* system of the Garhwal Himalaya farmers, could provide models for sustainable, highly productive, agricultural techniques. Recently the Kerala government announced a renewed thrust towards mixed fish-paddy cultivation systems to replace the HYV paddy fields.

Based on the bitter lessons learnt from the Green Revolution experience so far, and the several positive experiments being conducted throughout India, some broad steps towards a biodiverse, productive, and self-reliant agricultural system can be delineated:

1. *Promoting a geographical mix of systems,* with some areas devoted to high grain productivity (where biodiversity may be somewhat low) and other areas with high biomass productivity and social use value (where biodiversity will also be high). It is possible that the increasing need for foodgrains output may have to be met from conventional intensive farming, at least over the next few years when biodiverse farming is being revived or enhanced. This would probably be best done in irrigated plains, where grain productivity is already high, with care taken to minimize the use of fertilisers and pesticides. Simultaneously, a stress on biodiversity in the agriculture promoted in the hills, flood-plains, arid areas, and other 'marginal' areas, is absolutely necessary. Positive incentives would be necessary for this (see step 7 below). Eventually, however, even the irrigated plains must move towards diversity and organic inputs, to become sustainable.

   Promoting a mix also involves encouraging tree-crop, animal-crop, and tree-animal combinations, such as agro-forestry, fish-paddy cultivation, the Garhwali *baranaja-bhimal* system, and others. The productivity and need-fulfillment functions of these mixes is often much higher than the monocultures they are replaced with.
2. *Building on indigenous crop and livestock variety,* based on a thorough search for desired characteristics in this variety, including grain productivity, taste, smell, colour, drought

and disease resistance, ability to grow in adverse conditions, efficiency in input use, fodder output, and others. Although substantial work has been done along these lines in India, many traditional varieties are yet to be fully screened for their usefulness in specific conditions.

3. The introduction of compulsory *environmental impact assessment* (EIA) for agricultural projects. While EIA is now compulsory for most development projects like dams and industries, it is not yet geared towards looking at the impacts on agricultural biodiversity. In addition, many agricultural development projects are not subject to any EIA at all. What is needed is a process in which the introduction of irrigation, new cropping patterns, HYVs, or any other agricultural changes is preceded by such an EIA. This will help to determine the potential loss of biodiversity, which would be an important part of deciding whether the project should go ahead at all or not; if it is decided to go ahead, such an assessment would help to determine the steps needed to minimize the loss.
4. The encouragement of a diversity of food crops in the *public distribution system*, including bajra, jowar, ramdana, and others. This will help to counter the bias towards wheat and rice in both domestic consumption, and in production. Indeed, a guaranteed off-take by the PDS of a diversity of cereals and other crops would be a major incentive for farmers to continue growing them. This will have to go hand-in-hand with public awareness campaigns promoting 'lesser' cereals like *jowar*, *bajra* and *ramdana*.
5. Much greater *involvement of women* in decision-making with regard to agriculture, from the individual field and village to national policies. It is women who conduct much of the harvesting, seed selection, sowing, storage, and other processes which conserve and enhance crop diversity, yet their role in decision-making is often marginal. It is well-known that women are far more reluctant than their menfolk, to let go of their traditional seeds and adapt new ones, because for them domestic consumption is more important than market profits.

6. *Reorientation of agricultural research and development* (R&D) from its current pre-occupation with a narrow definition of productivity, towards looking at rural systems in totality. Research must go much more into the total biomass production of a village ecosystem, including that of tree-crop-animal systems, and of individual fields which are biodiverse as opposed to those which are monocultural; into multiple cropping systems like *baranaja;* into the revival and enhancement of indigenous crop varieties and livestock breeds; and into the various incentive systems which would encourage farmers towards biodiverse agriculture. This will require changes in attitudes and programmes at the level of national agricultural research centres, agricultural universities, decentralized centres like the Nehru Krishi Vigyan Kendras, and of course the agricultural extension workers.

   In addition, R&D (including breeding) will have to become much more participatory. This does not mean that formal research centres will decide on research priorities and programmes, and merely ask farmers to participate; rather, it means that the agricultural R&D will emanate from the needs and opinions and knowledge of farmers, and its results will be tested and implemented by farmers, with the formal sector acting as a support structure. This is a radical shift in attitude and methodology, with modern agriculture scientists treating farmers as scientists and researchers in their own right, and working towards collaborative R&D. As rice expert Dr. Richharia states:

> "It is vital that the application of science to rice agriculture and effective control of rice agriculture should remain in the hands of rice farmers...."[15]

Finally, agricultural R&D must also learn from and integrate traditional Indian agricultural sciences. The Lok Swasthya Parampara Samvardhan Samithi, an all-India network of people and groups committed to the revival of local health care systems, has documented the enormous range of prescriptions that systems like *vrkshayurveda* (plant

science) and *mrgayurveda* (animal science) had, many of which are relevant and useful even today. Equally important, these and other systems displayed a deep understanding of, and empathy with, the workings of nature, and built up elaborate theoretical foundations based on this.[16] Their holistic approach is only now being approximated by modern ecology, trying to break away from the piece-meal approach of western science, which treats each subject as a separate entity reducible to a few principles.

7. *Reorientation of the agricultural credit and subsidies system* towards encouraging biodiverse farming. Today's credit system, biased towards tractors and Green Revolution inputs, is a major disincentive for biodiverse agriculture. It must be completely reversed towards forms of farming which can combine diversity and productivity, and which help farmers become as self-reliant as possible in the availability of essential inputs. The question of subsidies (e.g. on organic manure, indigenous seeds) is less clear, since over a long period, subsidies are not sustainable and do not encourage self-reliance. However, many small and marginal farmers may require some form of subsidies to help them switch over to organic farming, with the clear understanding that these are for a temporary period only.
8. *Strengthening the ex situ collections* with the aim of servicing in situ cultivation. While the gene banks of India hold considerable crop diversity, and have done a reasonably good job of collecting and preserving this diversity, they must now become actively associated with returning varieties to the communities from where they came, accompanied by appropriate educational and material inputs which can help to revive their cultivation. Gene banks can also associate with movements like the Beej Bachao Andolan, in a search for varieties lost in the field, in returning varieties collected from their regions, in experimenting with these and other varieties in current *in situ* conditions, and in encouraging community seed banks.
9. Building up *direct producer-consumer links*, between organic,

biodiverse farmers and people who want wholesome food/products, as in the examples given above. More formal links than what has been tried so far, are still very tentative. Considerable work needs to be done on building up a responsive and cheap transportation arrangement, ensuring the availability of widespread distribution centres, quality control and certification, labeling and packaging, and other essential steps. However, it is clear that if these are taken care of (as they are for conventionally grown food), there is substantial consumer demand for biodiverse organic food.

10. *Rewarding informal innovations* in crop and livestock genetic resource conservation and use, and securing the *common property and intellectual rights* of farming communities. This subject is treated in greater detail in the next chapter.
11. Strictly *restricting the non-food cash cropping land* to a bare minimum. If even a part of the millions of hectares of land in India which are currently being used for tobacco, sugarcane, cotton, eucalyptus, tea, coffee, and other such monoculture plantations, could be converted back to food-growing lands, our foodgrains output would very quickly go up without having to pump in artificial inputs in intensively managed areas. This will of course, adversely affect our foreign exchange earnings, but surely local and national self-sufficiency is more important?
12. Strictly *limiting urban and industrial growth*, such that it does not eat up prime agricultural land, especially land where biodiversity has been retained or can partly be revived. For years the government has accepted the need for a land-use strategy which would help to regulate the diversion of agricultural land, but this is yet to be formulated and applied. Many state governments have laws by which agricultural land cannot be given to non-agriculturists, but there are many loopholes in this, and the government often acquires the land itself for 'developmental' purposes. In any case, some state governments are now considering relaxing the regulations, to make it easier for industry to acquire farming land.[17]

13. Urgently *identifying regions rich in the wild relatives* of crops and livestock, and conserving them. A commendable first step was taken several years back by the Meghalaya Government, by declaring a citrus sanctuary in the Garo Hills, an area rich in the wild relatives of citrus fruits (lemon, oranges, etc.), banana, and mango.[18] Other state governments should follow suit. There may be hesitation in setting aside areas which can be converted to agricultural or industrial use, but consider this: a wild variety of rice, *Oryza nivara*, found in Uttar Pradesh, was able to provide genes resistant to one of paddy's most destructive pests, the brown planthopper.[19] Varieties using these genes are now grown over 30 million hectares in South and South-East Asia. If the area where the species was found had been "developed" for human uses, we would have lost it forever. This is not an isolated example; as elaborated in Chapter 1, continued survival and enhancement of agriculture depends on the continued availability of wild relatives (and traditional varieties) of crops.

There is nothing original in the above steps; they are only a distillation of the lessons learnt from the experience of India's Green Revolution on the one hand and of India's organic farmers on the other. But though the answers are staring us in the face, India's agricultural establishment is extremely slow to take heed. This is understandable (though not justified), because the question of providing food security through biodiverse agriculture is ultimately related to large economic and social issues: where and what kind of incentives and support measures can be devised for such agriculture, what kind of consumer demand can be generated for wholesome organic food, what land-and-water management systems can be evolved so that fertile agricultural lands are not sacrificed for urban or industrial use, how much we can reverse the trend towards converting food cropping lands to short-term cash cropping.

Government agencies and community groups continue to remain subject to an overall agricultural policy which encourages and financially subsidizes the destruction of biodiversity. Indeed, the recent thrust towards agro-exports and agro-product

processing, under the current government's economic liberalization and structural adjustment policies (inspired, no doubt, by the IMF and the World Bank), is likely to intensify this destruction. There is a certain homogenizing logic to the global market, which demands standardized, easy to package and easy to price goods. Incentives are likely to increase for farmers to grow such produce for export, rather than for achieving localized self-sufficiency, at least in foodgrains. A fresh threat comes from the pressure to introduce private intellectual property rights (IPRs) on crop varieties, especially through the General Agreement on Trade and Tariffs (GATT), an issue which is discussed in greater detail in the next chapter.

In the final analysis, agricultural biodiversity can only be saved, as is the case with wildlife, if the country's path of development undergoes fundamental changes. Currently, the development policies appear to be heading further in the direction of destruction and unsustainability. Unless the new economic policies and the proposed changes in legal regimes governing agriculture are challenged with united action and alternative visions, concerns related to biodiversity, sustainability, and equity will remain subordinated to the lure of profit. It is in this context that the efforts of mass movements and activist groups gain critical importance. The Beej Bachao Abhiyan in the Himalayas, the farmers movement in Karnataka represented by the Karnataka Rajya Ryoth Sangha (famous for its anti-Cargill demonstrations), the forces struggling against the new economic policies and against the imposition of the GATT regime in India (despite their tendency to exaggerate and distort the essentially destructive nature of these trends), and a host of other popular struggles are critical components of a move towards a more sustainable agricultural future.

In all this, even though their work is on a quiet and relatively undramatic scale, and will probably never make the morning headlines, it is the thousands of farmers and groups and communities which are reviving or experimenting with crop and livestock diversity, who are providing the final answer. There is no force more powerful than the one which asserts and ensures local self-sufficiency, and helps farmers rid themselves of the

debilitating dependence on industry-dominated markets and elite-dominated governments. That, finally, is the message that the Beej Bachao Andolan, Navdanya and others are giving, and that Indian agriculture must heed.

A FINAL WORD

As in the case of wildlife, there are several aspects of agriculture which have not been touched upon above, both for reasons of space and because my own experience of them is limited. Of these, I would especially point to plantations, fisheries, pastoralism, and shifting cultivation. As discussed earlier, traditional agricultural systems often had a complex mosaic of trees and crops and pasture lands; plantations themselves were rarely monocultural. This has substantially changed in the last few decades, with vast stretches of single-species plantations (tea, coffee, banana, coconut, etc.) coming up with the sole aim of maximizing profits. Serious biodiversity loss has taken place as a result. A major challenge in the future would be to revive diversity on such lands.

The case of fisheries is similar, though perhaps there has been less homogenization so far. India's coasts have seven million fisherfolk, most of them dependent on traditional forms of fishing. Some of the fishing communities have (or had) elaborate rules regarding fishing, to ensure sustainable harvests. Closed seasons were strictly followed. Knowledge among fishing communities, of the aquatic flora and fauna, is quite remarkable. For instance, the Lakshadweep Islanders can recognize over 100 species of marine (including coral reef) fish.[20] The last few years have seen the increasing entry of large-scale mechanized vessels, often owned by outsiders or by a handful of rich fisherfolk, which have caused havoc to the coastal and marine ecosystem and to the livelihoods of traditional fisherfolk. Not only fish diversity, but other fauna are also affected; dolphins, dugongs, turtles, and others are victim to the extensive netting practices of these vessels.

Exports of fish and fish products as a whole, with marine

products as their major component, have more than tripled in value in the first four years of the 1990s.[21] In the same period, 82 companies were given clearance for joint (foreign and Indian) venture marine fisheries, using 255 deep sea fishing trawlers. According to available data, fishery stocks in most of the world's seas have been exploited to their full potential, or even over-exploited;[22] the Indian ocean is an exception. It is obvious that the major fishing companies, and the rich fish-eating nations, are eyeing our waters to satiate their large appetites. Unfortunately, lured by foreign exchange prospects, our government has given in to this unjustified and unsustainable demand. Proponents of trawling claim that these ventures will be allowed to fish only in deep waters, where traditional fisherfolk do not go. But past experience has shown that trawler owners find it convenient and cheaper to fish closer to shore.[23] Also, trawlers are often used in the fish-breeding season, when traditional fisherfolk usually give the seas a rest. The results, for India's marine ecosystems and traditional fisherfolk, are already proving to be disastrous. Physical clashes between trawler owners and local fisherfolk are a common occurrence.

Fisherfolk and farmers along the coasts will also be seriously hit by the spate of new prawn and shrimp farming ventures which are being cleared. There has been a rapid expansion of such aquaculture, largely oriented to the foreign demand for sea-food. Such farming involves intensive management of coastal ecosystems, oriented to a single species; this invariably distrupts the delicate salinity balance of coastal areas, causes pollution, and reduces their biodiversity. In many countries of the world (Thailand, Mexico, Ecuador), such farming has destroyed large stretches of mangrove forest, and caused serious pollution.[24] In India, surveys by the National Environmental Engineering Institute (NEERI) have shown serious negative impacts in Orissa and other states. The environmental and social repurcussions have been shown to have economic implications as well; for instance, the report notes that in Tamil Nadu, there was a net loss of Rs. 142 crores due to damage to farm land and salt pans, wage losses to farmers, fall in rice production and losses in fishing income.[25] Since large-scale operations standardized to

meet stringent export requirements are affordable mainly by big companies, benefits hardly go to small fisherfolk.

Both the public and private sectors have big plans for aquaculture in the country. The head of the Aqua Foundation of India, M. Sakthivel, has projected a jump of shrimp exports from 70,000 tonnes in the mid-1990s to 2,00,000 tones by 2000 AD, stating that "the world is looking to India to meet its shrimp requirements."[26] The Gujarat Fisheries Development Corporation and other agencies have signed an agreement to develop one lakh hectares of the state's coasts for aquaculture.[27] Of a total of 1.4 million hectares of brackish water area in India, upto a million hectares may be suitable for such operations.[28] The promise is that these projects will provide employment to several million people, cause minimal environmental damage and no displacement, and of course earn the country immense foreign exchange. However, studies of farms which have been set up in the last few years, for instance in the Nagai Quaid-e-Milleth district of Tamil Nadu, and the Nellore district of Andhra Pradesh, have shown that serious pollution problems have been caused by prawn farming, and that per unit of area, aquaculture has provided less than half the employment that farming previously did.[29] In addition, considerable depletion of groundwater has taken place, and the salinity of the water and of the soils on land surrounding the aqua-farms, has increased significantly. Threats have been reported to the biodiversity and livelihood resources of ecologically sensitive areas like the Pulicat Lake Sanctuary (straddling Andhra Pradesh and Tamil Nadu), by indiscriminate expansion of aquaculture. Similar experiences are being reported from other parts of India's coastline.

Fortunately, there is now a strong movement among the local fisherfolk, fighting against trawlers and aquaculture. While they may be focusing on safeguarding their own livelihoods, some of them are also articulating ecological concerns, and in any case, the results of their campaigns are helping marine diversity to survive. Due to them, the Government of India in 1996 banned all further joint ventures in deep seas, and the Supreme Court has ordered a stay on aquacultural development.

The most neglected are possibly our migrant communities, both pastoralists and shifting cultivators. Such communities have been affected by the loss of pastures and forests, blockage of migratory routes, and the hostility of settled populations whose cultivation practices have changed so that migrants are no longer welcome. Some of India's most uniquely adapted livestock breeds and crop varieties which were found with such migrants, are now increasingly being lost. There is still no clear policy thrust on these communities, or on the deep ecological knowledge they hold.

Plantations, fisheries, pastoralism, and shifting cultivation, among other topics which I have not been able to deal with in detail, are critical areas of research and social intervention, for anyone interested in saving India's biological diversity. Their neglect in this volume is not a measure of the importance I give them, but simply a reflection of my own inexperience.

4

People, Patents, Profits

In 1993, Kalpavriksh, a Delhi-based environmental NGO, released information that it had received from the Rural Advancement Foundation International (RAFI), a Canadian group, about the patenting of several micro-organisms taken from India by American pharmaceutical companies. Apparently these companies (including such giants as Bristol-Myers, Merck, and Pfizer), or their agents, took the microbes without any intimation to Indian authorities (not in itself illegal, since there is as yet no law regulating such transfers), tested their possible use in pharmaceuticals, and submitted them for patenting. Many of the patents had already been granted when the RAFI, delving into the records of the American Type Culture Collection, unearthed the information. In effect, what should rightfully have been thought of as the property of nature, or of India, was being claimed as the property of some private corporations sitting thousands of kilometres away from their place of origin. In the U.S., these corporations now have the monopoly right to use these microbes for industrial applications. Conceivably, if their patents get worldwide recognition under the new trade regimes of GATT, even Indians seeking to use these micro-organisms will have to seek the permission of these American firms, and probably also have to pay through their noses for the privilege!

The news managed to make headlines in one economic newspaper, and an alert Member of Parliament raised a question in the Lok Sabha, seeking to know what the government was planning to do about the "gene theft." The query came to the

Union Ministry of Environment and Forests, who did not know how to answer it, and passed it on to the Department of Biotechnology, which pretended not to know anything about the matter, and sent it back to the ministry; finally, some vague answer was drafted and presented in Parliament. Meanwhile, Kalpavriksh, which had demanded action to retrieve the microbes and the profits derived from their use, got a response from the Department of Biotechnology stating that a committee which was considering new legislation to allow patenting in India, would consider the matter. Three years have passed since then, but nothing more has been heard from either of the government agencies; the files are probably buried and forgotten. Ironically, the very same companies are being welcomed with open arms by the Indian government, to set up pharmaceutical ventures here!

This was a small incident, but it illustrated many of the complex policy issues plaguing the world of biodiversity conservation and sustainable use. Should the biological resources of one country be freely available to another country, in the spirit of "common human heritage"? Or should countries have the right to demand appropriate financial and other returns for the transfer of their genetic material? Do humans have the right to patent other life forms? Should private monopoly rights be allowed on biological and genetic resources, or on knowledge and technologies related to these resources? What kinds of rights should local communities, who have nurtured and developed biodiversity for much longer than modern societies, have vis-a-vis resources and knowledge? Should such resources and knowledge also be available in the spirit of "common heritage", or its local equivalent, "national interest?" If equality and justice are basic goals to which all societies ought to strive, how do they get achieved in the context of biological resource use?

Even more so than in the case of conservation, these issues are obviously in the realm of the social, political, and economic relations between countries, communities and corporations. Some of the major conflicts and complications in these relations, and the kinds of answers which people are groping for, are explored in this tract.

This chapter looks at the international and national context of these issues, including the inequalities in sharing the benefits arising from the utilization of biological resources, and the implications of intellectual property rights. Chapter 5 explores methods of regulating access, to generate an equitable sharing of benefits between and within countries. The basic thrust of the argument is that since the principles of global heritage and national interest are prone to be misused by the dominant countries and classes of the world, there is a need for some kind of regulation on access to biological resources, but that this regulation should not be in the form of monopolies.

THE CONTEXT

The bulk of the world's biological diversity, about 70 per cent of all recorded species, is concentrated in the tropics.[1] This figure is for wild plants and animals; in the case of agricultural biodiversity, the figure is perhaps even more striking. Indeed, the majority of the world's most widely used crops (including cereals, fruits, vegetables, pulses, spices, and others) have originated in tropical countries; the genetic material derived from these contributes nearly 92 per cent of the global production of food crops.[2] But there has also been a tremendous exchange of genetic resources between tropical countries, so that even in India, the centre of origin of so many important crops, agriculture is heavily dependent on genetic material from other countries.

There have been several avenues for this global exchange: international trade, forced transfers during and after colonial times, botanical and zoological expeditions, scientific exchanges, even accidental 'stowaways.' Going as far back as 2500 B.C. when the Egyptian Pharaoh Sankhkere sent an expedition to the Gulf of Aden seeking cinnamon and cassia, and on to colonial times when imperialist powers took away a large range of native plants and animals and established them in far-flung colonies, and continuing on to recent times when private corporations

have joined the fray, the history of this exchange is fascinating and complex.[3]

Coffee provides an interesting example of the scale of movement of genetic resources during colonial times. Native to Ethiopia, the coffee bean was transported by Arab or Persian traders to Yemen for cultivation at least a thousand years ago. A mere seven seeds were later sent to be grown in India, and subsequently in Sri Lanka. When the Dutch took over Sri Lanka from the Portuguese, they took one coffee plant to Indonesia (Java), and a single cutting from that tree was shipped to the Amsterdam Botanical Garden in 1706. Nine years later, cuttings from the Amsterdam tree were packed off to the Dutch colony of Surinam. Other cuttings were shipped across the Atlantic to Martinique in 1723. Thus, the entire coffee industry of Latin America comes from seven plants taken from Yemen a thousand years ago, and one plant taken to Java less than 300 years ago.

Several tropical countries have, from time to time, tried to block the outflow of genetic material from their territories, but this has been systematically undermined by Northern countries not only during colonial times but also subsequently. For instance, Brazil had banned the export of rubber germplasm, to protect its infant rubber industry, and Peru and Bolivia made trade in quinine (extracted from the bark of the cinchona tree) a government monopoly. However, in the nineteenth century, botanists from the famous Kew Gardens in Britain literally stole rubber and cinchona plants from South America, in what Kloppenburg[4] calls "operations of Bondian intrigue."

Germplasm collection and outflow from the tropics continues even today, with colonial powers having given way to "prospecting" by corporations and scientific bodies. Pharmaceutical, food, agro-products, and a whole host of other industries have recognized the enormous potential of the largely unexplored genetic wealth of the tropics, and are using all the means at their disposal to obtain this wealth. Their home countries in the North are, of course, paving the way for this transfer in various ways, including distorted international trade and aid policies and programmes, and various forms of scientific collaborations. Japan has launched a major biodiversity research

programme in Micronesia. The US National Institute of Health (NIH) and National Cancer Institute (NCI) have undertaken possibly the world's single largest programme of screening wild species from all over the tropics. In 1986, the NCI launched a five-year $2.8 million programme to screen thousands of exotic plants from the forests of Latin America, South-East Asia, and Southern Africa, the aim being to find compounds active against HIV and cancer.[5] For decades, small private firms and botanical gardens around the world have supplied pharmaceutical firms with chemical extracts for screening, a practice which is only increasing.

With such a long history of germplasm collection, it is not surprising that the advanced industrial countries, though extremely poor in naturally occurring or agricultural plant diversity, are as rich in *ex situ* gene collections as the tropics. Indeed in a number of crops (wheat, barley, food legumes, potato), some industrial countries today possess more stored germplasm accessions than the nations of origin or natural diversity of these crops! Over half of the world's gene bank holdings are now with the western countries, and another one-fifth with international organizations controlled by western countries and corporations.

Current economic regimes indicate that the 'developing' countries have massive debts to pay off to the industrialized nations. What these regimes ignore is the far greater debt that the latter have incurred over the last few centuries, in terms of the natural resources which have flowed to them from tropical countries. Much of this flow has been without adequate, or any, renumeration; this is especially the case with biological and genetic material. The total economic value of the germplasm which has been taken from the tropics to the North, or which has been transferred within the tropics from one country to another, is probably incalculable. But some examples below will give an indication of its magnitude.

Of over 100 crop species of major economic importance in the world, only 16 (sunflowers, blueberries, cranberries, pecans, Jerusalem artichoke, black walnut, black raspberry, American red raspberry, muscadine grape, American wild gooseberry,

wheatgrass, tufted hairgrass, oats, rye, currants, and raspberries) originated in USA, Canada, and northern Europe.[6] Australia has contributed nothing at all to the global larder. The enormous strides that agriculture has made in these countries, including the massive profits earned, have been based on genetic material taken from the tropics: corn from Nicaragua, wheat from Ethiopia, alfafa from Iran, soyabean from China, and so on. Nor is this a thing of the past; the agriculture of the industrial countries continues to be dependent on fresh infusion of genetic material from the tropics.

Agriculture is not the only global beneficiary of tropical genes. Other sectors include pharmaceuticals and biotechnological applications of various kinds. The value of tropical plants of medicinal importance to the global pharmaceutical industry will, by the year 2000, range from $4.9 billion to $47 billion, depending on various different estimates.[7] A specific example is Madagascar's rosy periwinkle (*Catharanthus roseus*), an insignificant-looking plant which has been spread far and wide by human agency, and now grows on roadsides in many other countries (including India). The periwinkle is the source of two anti-tumour agents, vincristine and vinblastine. The commercial sales of drugs derived from these amount to about $160 million per year.

If even more dramatic examples are needed, take the cinchona and rubber; both 'discovered' in South America (where they were already in use by local indigenous populations), the former revolutionized malaria cure, while the latter is such an indespensable part of modern civilization that its absence is unthinkable. How would one value the economic contribution of this genetic material? Another striking example, this time of the future potential of an as yet 'undiscovered' material, is of teosinte (*Zea diploperennis*). This wild relative of maize, which botanists chanced upon in Mexico, has the unique property of being a perennial (maize is an annual). An economist has estimated that perennial corn bred from teosinte could be worth as much as $6.8 billion per year.[8]

What is important here is that all these contributions of tropical genes to the agricultural and industrial might of the

North, have been largely unpaid for. Ethiopia, Madagascar, Mexico... virtually none of the countries of origin have received a share of the economic benefits reaped by industrial countries. Indeed, in many cases these countries of origin have had to pay a heavy price; the transfer of rubber to Asian countries by the colonial nations, and its success as a plantation crop there, led to a fall in the global market share of Brazil from 95 per cent to a mere 5 per cent. The resulting destitution caused severe social unrest.

The economic inequality of the transfers continues. The Canadian group RAFI estimates that germplasm benefits from just four of the commodities taken from international gene banks, which store a considerable amount of tropical genetic diversity, are worth about $3.8 billion annually to industrial countries (who put in about $300 million annually for these banks). There is as yet no move to share a part of these profits with nations from where the material originated.

INDIAN GERMPLASM ABROAD

A considerable amount of genetic material has gone out of India in the last few centuries (while much has also come in from other tropical nations). There is no comprehensive information on this, but some indicative examples are available. Spices, cotton, soybean...these were some of the groups which went out in the nineteenth and early twentieth century. In more recent times, Indian sorghum has helped American agriculture introduce resistance to a major pest, reportedly resulting in $12 million in early benefits; an extract from *sarpagandha* (*Rauvolfia serpentina*), a medicinal plant used for centuries in India, is used as a base in tranquilizers and other drugs used to treat hypertension and schizophrenia, the sales of which in the USA alone exceeded $260 million per year; the Himalayan yew (*Taxus baccata*) is being tested for a possible ovarian cancer-combating extract, and is now in high demand due to the short supply of its American relative *Taxus brevifolia*. The private sector companies W.R. Grace and P.J. Margo Co. estimate that the global market for their

neem-based biopesticides could reach $50 million per annum by the end of the century.

Several multinational pharmaceutical companies have realized the potential of Indian's germplasm. They are setting up ventures for prospecting and drug or seed production, often with local collaborating companies. The Hoechst Research Centre, a part of the giant pharmaceutical Hoechst's worldwide laboratory network, is one of the more ambitious of these. Shivanand Kanavi reports that the centre's botanists study Indian medical texts, and visit herbaria and areas where the plants grow. They collect enough plant material for their own herbarium and prepare extracts for analysis. Potential drug candidates are then put before the U.S. Food and Drugs Administration for clearance, after which the product can be marketed. Several other companies are getting into the act.[9] Sandoz India has entered into an agreement with Northup King of the U.S., subsidiary of its multinational parent company and also with the Dutch vegetable king, Zaaduine. The Indian Tobacco Company (ITC) is tying up with Pacific Seeds, a subsidiary of Continental Grains from Australia. The U.S. company, Cargill Inc. has set up an Indian subsidiary, Cargill Seeds India. Two other U.S. companies, Seetec International and Dehlgien have entered into agreements with the Maharashtra Hybrid and Nath Seed Company, respectively. Pioneer Hi-Bred has started an Indian subsidiary, Pioneer Seed Company. Hindustan Lever (a subsidiary of Unilever) is negotiating with a Belgian firm, while Hoechst and Ciba-Geigy are moving in reportedly with other tie-ups. Merck is also starting breeding programmes here. Not surprisingly, the major interest of these MNCs (and of big Indian companies) is in hybrid seeds; the 'vigour' of such seeds is available only in first generation hybrids, and gets lost in succeeding generations, forcing farmers to buy them every year or two years.

GLOBAL HERITAGE, NATIONAL SOVEREIGNTY, AND LOCAL PROPERTY

The hectic international genetic traffic of the last couple of centuries has been based, explicitly or otherwise, on the position

that biological diversity is a common heritage of humanity. Unfortunately, global political relations being what they are, such "common heritage" can be misused by the powerful. Having taken freely from the tropics, industrial countries and private corporations have then monopolized the resulting financial and technological benefits, the latter through the weapon of intellectual property rights (discussed a little later). The genetic resources of the South are not merely 'found in nature', but survive due to centuries of careful nurturing by local communities, or (in the case of crops and livestock) are the result of ingenuous innovations by farmers and traditional healers. If the principle of "common heritage" is to be applied to them, it should then also apply to the crop/livestock material and the biotechnologies developed by the north. However, all moves by tropical countries to obtain these free or at concessional rates, have been resisted, especially by private corporations.

A well-known example of these double-standards is the International Undertaking on Plant Genetic Resources. The undertaking, negotiated at a conference of the U.N. Food and Agricultural Organisation (FAO) in 1983, committed countries to a free flow of plant germplasm. Over a hundred countries, including India, have so far adhered to the undertaking. Significantly, however, several industrialized countries (including Germany, Canada, U.S.A., France, Japan, New Zealand, United Kingdom, and Switzerland) had till recently refused to be a party, because the undertaking clearly included, within the ambit of genetic resources to be freely exchanged, not just traditional cultivars and wild species, but also varieties newly developed by the scientists of the north.

An International Fund of Plant Genetic Resources was created in 1987 to help in carrying out the provisions of the undertaking, including the conservation and utilization of genetic resources to the benefit of tropical nations. However, the fund never got going as the industrialized countries refused to contribute to it. It is notable that even a 1 per cent share of the global sales of modern-bred seeds could have yielded millions of dollars, but this was not forthcoming.

Finally in 1989, FAO succumbed to pressure, and passed

resolutions which recognized Plant Breeders' Rights and Farmers' Rights. The former gave breeders the possibility of blocking their varieties from being freely exchanged (as was provided for under another international agreement signed by industrial countries; see below, on UPOV, under the discussion on intellectual property rights). Unfortunately, the same regulatory power should have then been extended to farmers for their crop varieties; however, the undertaking merely defined Farmers' Rights as "rights arising from the past, present and future contributions of farmers, in conserving, improving and making available plant genetic resources, particularly those in the international community, as trustee for present and future generations of farmers, and supporting the continuation of their contributions, as well as the attainment of the overall purposes of the International Undertaking." Sounded nice, but it meant little. Farmers' varieties were still up for grabs, while the formal breeding sector (mostly private corporations) retained control of its own products.

International inequalities in access to biodiversity, and to its benefits, are mirrored in the relationships between various classes within a country. For instance, dominant elites within India (or for that matter most other nations) have a greater control over natural resources than the poor. More specifically, the urban rich have greater access to elements of biological diversity, and to the profits derived from them, than do rural communities. This is despite the long history of control and management of natural habitats by local communities (as discussed in Chapter 2). With the disruption of this system, by the centralization of ownership and control during the colonial period and after, access and benefits have also been increasingly cornered by a handful of rich and powerful groups.

As discussed in Chapter 3, local communities were not only responsible for the conservation of natural habitats, but also for finding new uses for biological resources, including developing a diversity of crops and livestock. A considerable amount of individual and communal effort and expertise went into this process. A substantial part of the crop 'improvements' done by modern biotechnology, or drugs developed by the

pharmaceutical industry, are based on this traditional wealth of knowledge and resources. Virtually every one of the nuts and fruits grown in western countries (with the sole exception of the Australian macadamia nut of Australia) was originally grown by indigenous communities.[10] Rubber was already in use by the Amazonian tribes when the modern world 'discovered' it. *Sarpagandha* (*Rauvolfia serpentina*) was used by generations of Indians before allopathic medicine, taking its cue from traditions, hit upon its properties. The world's elite thus have an incalculable past and continuing debt to traditional communities all over the world.

But very few of the benefits accruing from the use of germplasm and related knowledge developed by a local community, has flowed back to this community. The argument, parallel to the "global heritage" justification between countries, is that such use is of "national interest", and that no one should have the right to block resources which "belong to the nation." This notion is ideal, for resources should indeed be public goods. However, national interest has been grossly and consistently misused, to take away resources and knowledge of local communities without a concomitant flow back.

Vast amounts of profit have been made by outsiders (national governments, national and multinational corporations, individual scientists and prospectors, and others), without anything being ploughed back. It is estimated, for instance, that the plant genetic screening process of a pharmaceutical corporation looking for useful characteristics in a new plant, gets reduced by as much as half to 90 per cent if the corporation also has access to traditional knowledge about the plant.[11] In India, the ayurvedic industry gets its plants from local people, to whom it pays a pittance compared to the eventual price of the developed drug. A great deal of non-timber forest produce (apart from medicinal plants), such as honey, fruits, and sal (*Shorea robusta*) seeds used in chocolate-making, fetch the local collectors a very small price; eventually the product, either in raw form or finished product, is sold at disproportionately marked-up prices. Similarly, the thousands of varieties of crops which have been picked up from farmers by agricultural scientists or seed

companies, have rarely even been acknowledged, much less rewarded. Admittedly, many of these resources and knowledge are widespread (e.g. the uses of neem tree), and it would be difficult to pinpoint the target of fees or other returns, but there are other ways of sharing benefits (outlined below) in such general cases.

It is therefore not surprising that peoples' groups in various parts of the world have begun to claim exclusive right, or at least prior claim, to the natural resources found on what they consider their land, to the crop and livestock diversity they have developed, and to the knowledge related to these resources. A number of declarations of indigenous and tribal peoples, for instance, have asserted this, as does the recently proposed U.N. Declaration of the Rights of Indigenous Peoples. The strongest support comes from the recently signed Biodiversity Convention, which may provide some legal teeth to this claim. The preamble to the Convention, commits countries to respect local community knowledge and practices, to take community consent before using such knowledge widely, and to share the resulting benefits with them on an equitable basis. This is discussed in detail in Chapter 6

It is much too soon for these declarations and agreements to have had an effect yet, but groups in many countries are putting pressure on their governments to implement their provisions, both by including it within national legislation, and by actual programmes. But what exactly do these provisions entail? How do communities effectively regulate access to their biological and intellectual resources? How does one 'equitably share' benefits with local communities? These and other related questions are simply not tackled. The next chapter attempts some tentative and incomplete answers.

BIODIVERSITY AND INTELLECTUAL PROPERTY RIGHTS

As noted above, one of the inequities of the international transfer of genetic resources has been that material from the tropics has been freely taken, but the derived products and technologies

have come back with a heavy price, or not at all. One method by which open access to these derived products and technologies is denied, is the imposition on them of intellectual property rights.

Intellectual Property Rights (IPRs) are rights to thoughts, ideas, and information regarding new inventions and processes, enabling an inventor to exclude imitators from the market for a specified time. The stated purpose of such rights is to stimulate industrial innovation, by offering higher returns (profits) than the market would normally offer. Copyrights, patents, and trademarks are commonly known IPRs. While such IPRs are several centuries old, their extension to living beings and related technologies is a recent phenomenon, and one which has evoked considerable controversy.

Till well into this century, IPR systems (other than copyrights) have been restricted to inventions of a technical nature which were industrially applicable. IPRs on living beings were therefore excluded, with scattered exceptions. One of these exceptions was the 1873 patent granted to Louis Pasteur for a "yeast free from organic germs of disease, as an article of manufacture."[12] In 1930, the U.S. Plant Patent Act was passed, which extended protection to "any person... who has invented or discovered and asexually reproduced any distinct and new variety of plant, other than a tuber-propagated plant." Several other countries also extended protection to plant varieties in the decades following 1930, a process which culminated in 1961 in the formulation of an international convention on the subject. This treaty, called the International Convention for the Protection of New Varieties of Plants, was initiated by European countries that had earlier formed a Union for the Protection of New Varieties of Plants (UPOV). Though signed in 1961, the convention became effective only from 1968 onwards. Nineteen countries are now party to the UPOV Convention, almost all of them from the industrialized world.[13]

Plant variety or breeders' rights (PVRs/PBRs) give the right-holder limited regulatory powers over the production of the reproductive or vegetative propagating material for the purposes of marketing. In most countries, and till recently under UPOV, other breeders and farmers were exempted from the application

of the restrictions, so long as they did not indulge in commercial transactions of the material. Now, however, full industrial or utility patents with far greater monopolistic rights are being awarded to new plant varieties. For instance, patents were granted in 1992 and 1994, respectively, to transgenic (genetically engineered) cotton and soybean, both in the name of the American company Agracetus.[14] This company is a subsidiary of W.R. Grace, the multinational which recently gained notoriety with the patenting of a neem herbicidal process. These patents give Agracetus monopoly over all genetically engineered cotton/soybean, regardless of the process by which it is produced and the company/individual who produces it. The ramifications of such a wide patent are discussed below. Strangely enough, Agracetus was granted a patent on transgenic cotton even in India, in violation of the Indian Patents Act which specifically prohibits patents on life forms and agricultural biotechnologies. Only when considerable controversy erupted over this, did the Indian government withdraw the patent.

Over the last decade or so, IPRs have been extended to micro-organisms and animals as well. In 1972, microbiologist Ananda Chakrabarty applied for a patent in the United States, for a genetically engineered bacterial strain which could degrade many components of crude oil. What was significant was that the patent claim was not only for the process of producing and using this bacterium, but also for the bacterium itself. After being rejected twice, Chakrabarty was granted the patent in a narrow majority vote in the U.S. Supreme Court. The decisive factor was the view, held by this majority, that anything made by humans and not occurring in nature was patentable.[15]

In the last couple of decades, the patenting of micro-organisms has been accepted in many other countries; in 1977, a Treaty on the International Recognition of the Deposit of Micro-organisms for the Purposes of Patent Procedure (the Deposit Treaty) was signed in Hungary. Further breakthroughs came rapidly as genetically engineered animals came under the purview of patents. The most infamous is the "Harvard mouse", in which the university was granted a patent for an "onco-mouse", which had been engineered to have a greater than normal tendency to

produce cancerous cells (and thus was useful in cancer research!). Over a couple of dozen claims for such animals are pending patents in the U.S. alone. In Europe, the European Patent Convention allows for the patenting of micro-organisms or microbiological processes, but not for "plant or animal varieties or essentially biological processes for the production of plants or animals." Curiously, the Harvard mouse was given a patent by the European Patent Office under the argument that it was the product of a "microbiological process!"

Patent applications are now pending for nearly 200 genetically-engineered animals, including a mouse with human genes developed by Integrated Genetics, which secretes t-PA from its mammary glands, and a human gene-bearing chicken, bred by Transgenic Sciences, that lays medically-useful eggs.[16]

Finally, as a logical extension of this process, even human genetic material is up for patenting. In 1993, a bombshell was dropped amidst already heated debates on IPRs. It was revealed that the U.S. Department of Commerce had sought a patent on a human cell line of a woman from the Guaymi Indian tribe of Panama, South America, developed from her blood collected by scientists in 1990.[17] The cell line was shown to be resistant to a particular disease, and could be potentially useful in research on AIDS and cancer. The Guaymi General Congress and the World Council of Indigenous People, alerted to the patent claim by some NGOs, immediately raised an international furore, stating that it was a moral affront for anyone to monopolize human genetic material. So embarassed was the U.S. Government that it withdrew the patent application.

The Guaymi controversy alerted NGOs to several other similar applications pending in the U.S. and Europe; it also shed new light on an international effort called the Human Genome Organisation (HUGO), the most ambitious project ever to map the human genetic structure. Under its Human Genome Diversity Project, sponsored by the United States National Institute of Health (NIH), scientists have begun an anthropological hunt for human tissue, hair, and blood samples, from indigenous peoples of the world.[18] This material will be stored at the American Type Culture Collection, Maryland. The

attitude of the researchers is shown in the language of the project documents. Since blood does not survive long without cold storage, the project authorities remark that "one person can bleed 50 people and get to the airport in one day!" (exclamation mark added). The 722 target groups, many of them in danger of extinction, and some potentially from India like the Andaman and Nicobar tribals, are called "Isolates of Historic Interest... because they represent groups that should be sampled before they disappear as integral units so that their role in human history can be preserved." Critics allege that there is no commitment on the part of the project authorities that such genetic material, or material derived from it, will not be put up for patenting.

These occurrences have awakened the world to the horrific implications of IPRs on life forms and biotechnologies, and have increasingly brought demands for severe curbs on this runaway, out-of-control juggernaut. A major blow to the biotechnological industry came in March 1995, when the European Parliament rejected a proposed European Community Commission directive which would have made patenting of plants, animals, and human genes possible throughout Europe.

IPRs on biological resources and related technologies or knowledge are justified much as industrial invention IPRs are: that they stimulate innovation by giving recognition and rewards to inventors, that they encourage investments in research, and that they make possible the eventual disclosure and dissemination of related knowledge. Whether or not these goals are met is hotly disputed, for the evidence that the lure of private profits is the only or even the most effective motivation for innovation is by no means conclusive. After all, the development of 50,000 varieties of rice by Indian farmers had little to do with private profit; at another level, the Indian public sector seed breeding agencies (Indian Agricultural Research Institute, etc.) have done considerable work motivated by the spirit of public welfare. Yet, even if it is true that in an increasingly monetized world, personal profits are a powerful incentive, IPRs on life forms have serious ethical, social, economic, and ecological implications, which must be considered while deciding whether

we, as a society, are willing to allow them.[19] Space permits only a brief discussion of these implications here.

Do we as a species have the right to claim ownership over other species; even more stark, does any one individual human being have the right to claim private monopolistic ownership over entire other species? However inventive scientists are in engineering a new strain of bacteria or a new variety of plant or animal, the essential elements with which they are working—the building blocks of life, and life itself—are not created by them. Increasingly we are beginning to accept the notion of equal rights for all living beings; IPRs take us back to the age of 'might is right'.

Establishing property rights over living beings has a strong philosphical rooting in western thought. The Cartesian worldview, for instance, held that science should make it possible for humans to "render ourselves the masters and possessors of nature."[20] For a civilization like India's, where oneness with nature has been a part of philosophy and to an extent even daily practice, this is an alien concept. Even in the West, sensitive individuals are questioning their alienation from nature, created by such an arrogant worldview. IPRs on living beings are the ultimate manifestation of this arrogance.

Serious ethical issues arise even more starkly in the case of attempts to patent human genetic material or information. The Guaymi case, cited above, is a classic case of a profit-hungry system that has abandoned any sense of morality.

Unfortunately, as mentioned in Chapter 1, ethical viewpoints no longer have as much acceptance in today's hardheaded world as considerations based on material self-interest. We must therefore now consider other implications of IPRs.

ONGE TRIBALS AND IPRS

In 1995, the debate on patents, community knowledge, and tribal rights, was suddenly reignited by news from the remote Andaman and Nicobar Islands.[21] Scientists working in the Regional Centre of the Indian Council of Medical Research, at

Port Blair, have been testing various plants that the Onge tribe of Little Andaman uses for medicinal purposes. It had been known that while the non-tribal settlers on Little Andaman suffer from a high incidence of malaria, the Onges remain remarkably unafflicted.

One of the plants tested, which has been used by the Onges against fever and gastro-intestinal disorders, was found to have potential anti-malaria properties. Most exciting, it appears to be active against the dreaded malarial parasite, *Plasmodium falciparum*, which causes the debilitating and often fatal malignant and cerebral forms of malaria. If this potential is confirmed, and the active ingredient of the plant can be isolated and used, the benefits would reach millions of people.

Suspecting that unscrupulous elements might misuse the information, the concerned scientist decided not to release the name of the plant. This was a wise move; the local NGO Society for Andaman and Nicobar Ecology (SANE) revealed that the Director of the regional centre has moved to apply for a patent on the find. Groups like Kalpavriksh then joined in, demanding that the plant (and the forests it is found in) be secured from possible exploitation by outside agencies, that no private monopoly IPRs be allowed on the find, that there be an explicit recognition of the rights and contributions of the Onge tribe, and that appropriate returns be given to the tribe if and when the plant is utilized for larger use. Amongst these returns could be the re-establishment of Onge land and forest use rights to the island; such rights have been curbed in the last few decades with the take-over of much of the island by outside settlers, armed forces, and others. Kalpavriksh also called for the formulation of sensitive policy and legislation on community intellectual rights, which could apply to all such instances in future. The Indian Council of Medical Research has responded with an assurance that it will await the formulation of such a policy before taking a step towards patenting or commercial use. The next few years will undoubtedly see many more such cases, which will test the commitment of the country to conserve, sustainably use, and equitably share the benefits of, biodiversity.

The impacts of IPRs are strongest on rural communities who

depend on the use of components of biodiversity, especially farming populations. As mentioned above, laws related to PVRs and PBRs in most countries have two important exemptions. One is the breeders' exemptions, which allows scientists and plant breeders to use protected varieties for further breeding work without paying royalty. This was aimed at ensuring that the socially useful activity of breeding improved varieties continued unhindered. The other, even more important, is the farmers' exemption which gives farmers the right to save harvested seed for their personal reuse, and for "across-the-fence" exchange with other farmers.

However, in both the UPOV Convention, as also at other forums, the biotechnology industry has increasingly demanded that these exemptions be withdrawn.[22] The amendments of the UPOV in 1991 have increased the monopoly role of breeders' rights. Whereas previously farmers' exemption was guaranteed by the Convention, it is now an optional exemption which countries may or may not impose. Unless specifically granted exemption, farmers now have to pay royalties for saving seeds on their own farms even under PBR regimes. In addition, the 1991 amendment reduces the scope of breeders' exemption. Given the power of corporate plant breeders to impose these rights and restrict farmers' and breeders' exemptions, the PBR regime becomes almost as monopolistic as industrial patents.

This means that while the user of a patented product would have the right to *use* the product but not to *make* it, a farmer purchasing patented seed would have the right to grow it, but not the right to save and replant it. A farmer who attempts the latter could be in violation of the law, unless specifically given exemption by the country in which he resides. The farmer would have to return to the market each year to purchase seed, as has to be done for hybrids at present. It would also be illegal for farmers to pass on harvested seeds to neighbours, or to sell it on a limited scale, affecting a widespread agricultural practice followed by farmers all over the world. According to Suman Sahai of the Gene Campaign, of the annual seed requirement of 600,000 tons for Indian agriculture, not more than 38 per cent is met by formal agencies like the National and State Seed

Corporations. The other 62 per cent is met by inter-farmer sales and exchange.

Such an eventuality is foreseen not only in the case of patented crops, but also patented livestock breeds. In 1988, there was a U.S. patent office announcement that the offspring of patented livestock would also be subject to royalty charges throughout the seventeen years of patent protection.[23] The logical extension of such a monopolistic regime could be that a farmer who has bought a patented breed of cow, would not own the calf of this cow!

Apart from the impact on individual farmers and farming communities, poor countries as a whole may also suffer the consequences of the new IPR regimes. For instance, the World Bank has reportedly estimated that if the United States forces other countries to pay royalties for its patented products, the additional outflow of foreign exchange from these countries would double or triple the amount which is already flowing out as debt repayments (about US $60 billion in 1988). Debt repayment is a major cause of environmental and social destruction in southern countries (see below); this destruction would be greatly magnified if a global IPR regime suiting American interests were to be imposed.

It is, of course, possible to argue that farmers do not have to use patented seed at all, and in fact that IPRs could force farmers to revive traditional seeds and farming practices (as has already happened in reaction to the Green Revolution in some parts of India; see Chapter 3). There are, however, aspects of the dominant agricultural policy which would defeat, or make very difficult, such attempts at being self-reliant. One of these is the increasing power of agro-corporations and/or governments to dictate the nature of agricultural operations on individual farms, especially in terms of pushing seeds, fertilisers, pesticides, livestock breeds, and other inputs into the rural economy. In a situation such as this, the patenting of crop and livestock varieties can only further trap farmers.

Moreover, even farmers who are able to retain a degree of self-sufficiency by relying on their own indigenous varieties, may face problems from patent holders who will increasingly claim

rights not merely to varieties, but to *characteristics* which are common to several varieties. For example, a patent has been granted to the corporation Sungene for the characteristic "high oleic content" in sunflowers. Already, Sungene has announced that the development of any variety high in oleic acid will be considered a violation of its patent. If this stands up in the courts, it means that a patent holder could prevent others from completing research even using totally different genetic systems, and could perhaps also prevent farmers from innovating on their own high oleic acid varieties of sunflowers. There may, indeed, be no end to this; as Cary Fowler and others have stated: "Why not a patent for 'tasty' bread or 'high-yielding' rice or for 'good' kids?"[24]

This dramatic possibility may not be as far-fetched as one would imagine. In the case of the Harvard mouse, for instance, the patent claim in Europe is not only to the mouse, but to "a transgenic non-human mammal all of whose germ cells and somatic cells contain a recombinant activated oncogene sequence introduced into the said mammal or an ancestor of the said mammal, at an embryonic stage."[25] Thus it is possible that Harvard could charge royalties on any non-human mammal, which has been developed for cancer research by injecting its embryo with an oncogene.

Finally, the emerging IPR regimes have serious implications for biodiversity itself. There may be no *direct* impact on wild plants and animals, since these are likely to remain outside the purview of patents. However, there could be severe indirect effects. For instance, as noted above, debt repayments of tropical countries would increase substantially. In the last few decades, attempts to repay debts have consisted of exporting natural resources in their raw form (timber, fish and other marine life, medicinal plants, orchids, etc.), or in the form of various processed products (agro-products, bird feather goods, medicines, etc.). More often than not, considerable over-exploitation is the result.

In the case of domesticated biodiversity, the impacts are both direct and indirect. As mentioned above, farmers may be forced to adopt the homogenous and genetically narrow base of modern

agriculture, and be unable to innovate on even the seeds or livestock they buy. Companies will want to maximize their profits, since patenting is an expensive process, and will therefore opt for as widely adapted varieties as possible. In such situations, there would be loss of indigenous crop and livestock diversity. On the other hand, farmers may also be induced into reviving and innovating on traditional diversity, as a means of reducing dependence on economically-crippling patented varieties. But for a large number of farmers who are deeply enmeshed in the market economy, dependent on governments and markets for their inputs and sales, such escape routes may prove extremely difficult. Moreover, the incentives provided by patenting could increase the thrust towards the commercialization of agriculture, oriented more towards industries and exports rather than towards domestic and primary consumption. Such a thrust is inevitably accompanied by the homogenization of crop varieties, since agro-industries and export markets prefer standardized products.

Fortunately, the Indian Patent Act of 1970 does not as yet permit the granting of patents on life forms and related technologies. These and other substances in the areas of agriculture, horticulture, and curing or enhancing human animal or plant life are not patentable "on the grounds of law, morality, and health" (Section 3). In the case of food, medicine, drugs, and chemicals, only process patents are allowed (Section 5), since it is believed that the grant of product patents will inhibit the discovery of more efficient and economical processes for the manufacture of the same product.[26] Experts have hailed these aspects of the Act as amongst the most socially progressive in the world.

Unfortunately, these provisions may soon become a casualty of the internationalization of IPR regimes, which is taking place under the UPOV and the General Agreement on Tariffs and Trade (GATT). While the sheer scope of this agreement is too vast to analyse here from the point of view of biodiversity, there are some key elements which give rise to serious concern.

GATT: THE NEW DANGER

In recent times, the most far-reaching international occurrence in the context of trade and IPRs is the latest round of GATT (the so-called Dunkel text). Concluded in 1993, this round includes sweeping provisions which integrate agriculture in GATT, increase trade in tropical products and natural resource-based products, and introduce uniform intellectual property rights regimes. Several aspects of this agreement have a bearing on biodiversity:

- One thrust appears to be to free the agricultural sector from all forms of controls and interventions by governments. A direct impact of this could be the easier entry of powerful multinational agribusiness corporations into Third World countries, corporations which would be able to push their crop and livestock varieties onto the farmer. This is already beginning to happen with the liberalization process in the 1990s, as discussed in the previous chapter. With GATT, Indian agriculture will move further towards commercialization and exports, with potentially disastrous consequences of the sort discussed above and in Chapter 3.
- Another change sought is the lowering of subsidies given to various agricultural inputs. On the one hand, this could have the impact of reducing the spread of modern agriculture (especially if fertiliser subsidies are removed), and spur a revival of organic farming methods. However, as pointed out in Chapter 3, positive incentives including subsidies may need to be given to help farmers switch to organic and high-diversity agriculture; under GATT, the possibility of such incentives could be reduced. At best, the result on biodiversity of a cut in agricultural subsidies would be mixed.
- Article 11 of GATT curtails the ability of countries to restrict exports of products except through duties, taxes, or other such charges. This could have potentially negative environmental consequences, since countries would find it difficult to enforce policies restricting exports of natural resources. In recent years, India's negative list of exports,

under which a large part of biodiversity (including threatened species) are protected from being exported, has been drastically revised under the impact of the structural adjustment and liberalization process started in 1991.[27] Many species or parts of species whose export was earlier prohibited have now been re-opened; further such relaxations could come under the influence of GATT. This is especially because, as recently stated by the government in its Economic Survey for 1994-95, the areas in which India allegedly stands to gain significantly from GATT are textiles, agriculture/forestry/fisheries, and processed foods/beverages.

- Serious effects could also be felt under the GATT provisions relating to intellectual property rights (IPRs). The agreement attempts to harmonize IPR systems across the world, primarily to meet the standards set in the industrial countries. However, in the case of life forms, the text appears to be more flexible. Article 27(3)(b) states:

"Parties may exclude from patentability plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, Parties shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof. This provision shall be reviewed four years after the entry into force of this Agreement."

The apparent flexibility of this clause may be largely illusory. Two major points have been raised by a number of critics. First, that it forces on countries the patentability of micro-organisms, leaving very little scope for a nation which may not want to patent any life forms. It is important to realize here that the terms "micro-organisms" and "microbiological processes" have been recently extended to include the genetically modified mouse patented by Harvard, as mentioned above. Secondly, it forces the adoption of some form of IPR, and thereby monopoly control, over plant varieties, even if each country is free to decide whether this will take the form of patents, PBRs, or some other

regime. In fact, even this freedom may be illusory, since countries are obliged to provide an "effective *sui generis* system", leaving open the possibility of GATT determining what is and what is not "effective." Given the trend of developments in international negotiations, the only systems recognized as effective may be the PBRs as codified in the UPOV Convention, or the model of industrial patents. In both cases, as shown above, the monopoly powers of the right holder have increased tremendously in recent times. If countries like India continue to disallow IPRs on plant varieties, the U.S. and other industrialized nations could use their clout to push them to change. Such pressure tactics have already been used bilaterally by the U.S.A., taking recourse to the word "effective" under Section 301 of its Trade and Competitiveness Act of 1988.

There is also the danger that, when this provision of the GATT text is reviewed after four years, compulsory patentability could be extended to plants too. How soon after that animals will follow is anyone's guess, but the trend is ominously in that direction.

The implications of GATT on Indian agriculture (and textiles, etc.) have evoked a remarkably high degree of debate within India, all the way from individual farmer's fields to the Parliament. By no means has all this debate been well-informed, with both sides tending to seriously exaggerate their points (farmers in Rajasthan have reportedly been made to believe that even sitting under a neem tree will attract a fine, once "Uncle Dunkel" takes over!). But serious analyses have been made by several groups, including networks like the National Working Group on Patent Laws (NWGPL) and the Gene Campaign. It is because of sustained and informed criticism, and considerable grassroots mobilization, that the Government of India took a long time in deciding its position; eventually, however, it gave in to international pressure and agreed to the latest GATT version in late 1993.

The Indian government has repeatedly stated that its trading partners have assured, that no uniform imposition of the IPR regime will be attempted, and that India will be free to evolve its own regime. It is too early to say whether this freedom is

imagined or real, but certain indications are available. Already, much before it was required to do so, the Ministry of Agriculture has drafted a Plant Varieties Protection (PVR) Act, aimed at extending IPRs to newly-bred crops. Roughly, this proposed Act corresponds to the UPOV text of 1978. The Ministry's text does provide strong exemptions to farmers, and attempts to create a fund for rewarding the innovative work done by them. However, in the face of the destructive forces which the Act may encourage, these measures could well be undermined. Here, for instance, is one possible implication: commercial seed breeders will find it expensive not only to breed new varieties but also to pass the stringent tests required for Plant Variety Rights applications. They will therefore be much more keen to push a handful of widely adaptable seeds, which can get them back adequate profits, rather than develop a diversity of seeds which are suited to a diversity of micro-situations. The same process of displacing local diversity by monocropping, which characterized the Green Revolution, could be greatly strengthened by the proposed PVR Act.

Also at threat will be India's public sector agricultural research efforts. Within the limited confines of the Green Revolution, these efforts have served India well, and have completely demolished the myth that private profits are essential incentives for creativity. However, with the private sector coming in with a bang, encouraged by the liberalization policies and lured by the promise of the PVR legislation, public sector research will take a back seat. This is unfortunate, for recently the public sector too has begun to take ecological and social concerns into consideration, and there were genuine chances of integrating diversity concerns in as well. Reorienting agricultural research is eminently possible, if the new policies do not derail this new direction. In the words of eminent rice scientist Dr. R.H. Richharia, former director of the Madhya Pradesh Rice Research Institute, and one of the few persons within the establishment to oppose the entry of exotic rice varieties into the country:

> The traditional agricultural systems and sciences as practised in India and South-East Asia have been to a great

> deal subverted in the past 25 years. The rice farmer who has a proud history of plant breeding and scientific eco-specific cultivation is today turned into a cog in the wheel of the agricultural 'sector' where his fund of knowledge is considered only 'tradition'.... It is vital that the application of science to rice agriculture and effective control of rice agriculture should remain in the hands of rice farmers....[28]

Also at threat is the Indian Patents Act. In 1995, a revised patent act was presented by the government to Parliament, the bill was not allowed passage in the Rayja Sabha, and is still pending approval at the time this goes to press. Amongst other demands, some MPs have stressed that the new act should exempt life forms from the purview of patents. It will be interesting to see how this works out, for under GATT, India is committed to allowing the patenting at least of micro-organisms and micro-organic processes. On the other hand, as mentioned above, the European Parliament also moved in 1995 to block moves to make all life forms patentable. In addition, the Convention on Biological Diversity gave hopes that IPRs may yet be possible to curb (see Chapter 6). These contradictory international trends will, along with movements within the country, have a significant bearing on the future of patents in India.

5

Regulating Access and Sharing Benefits

For some years, now, tropical countries have been looking for ways to regulate the outflow of their genetic resources, and claim returns for their use by the industrial nations. The failure of FAO's International Undertaking to forge a truly equitable global access regime, and the increasing trend towards IPR monopolies, has pushed this search for regulatory mechanisms. In the late 1980s and early 1990s, they found just such a tool in the Convention on Biological Diversity. In the inter-governmental negotiations leading up to this Convention, considerable time was taken on this issue. Though the initial draft of the text specified that biodiversity was to be considered the common heritage of humanity, this was quickly shot down by tropical countries, who proposed, instead, the overarching principle of national sovereignty over biological resources. India was one of the key pushers of this position. Eventually, it was accepted: Article 15 of the Convention recognizes the "sovereign rights of states over their natural resources" and gives national governments "authority to determine access to genetic resources" on "mutually agreed terms" and with "prior informed consent." The article also calls for equitable sharing of the benefits arising from the use of biological resources. For a more detailed discussion, see Chapter 6.

The establishment of national sovereignty as a matter of international law, can potentially be used to reverse historical inequalities in the access to genetic resources. It will, of course, be up to individual nations to take appropriate legislative and

regulatory steps to use this potential. Both prior to and as a result of the Biodiversity Convention, many countries have begun doing this. In the Philippines, a presidential order establishes a regulatory framework for the collection of biological/genetic material and its by-products and derivatives, for scientific, commercial, or other purposes. It designates a committee to ensure compliance, consisting of members from various government departments, the national science community, NGOs, and indigenous peoples' organizations. The order makes it mandatory for a person, entity or corporation, foreign or domestic, to enter into research agreements with representatives of the Philippines government if they want to collect material. Two kinds of agreements are allowed: academic research agreements, and scientific research agreements.

The Indian government is also in the process of issuing an order to regulate the transfer of biological/genetic material occurring within the Union of India. By end-1994, a draft of this order was ready, but it subsequently got stuck at other ministries who were unsure about its potential impact. The draft order requires that agencies/individuals seeking to transfer biological/genetic material need the permission of the appropriate notified authority. However, it does not elaborate on the kind of transfer agreements that can be entered into. There are also other gaps. It does not mention steps necessary to ensure returns of the profits, and their fair and equitable distribution.

However, the biodiversity action plan which is under preparation in the Ministry of Environment and Forests, has significant sections on access and benefit sharing. It proposes the creation of an authority at the national level which can enter into a material transfer agreement (MTA) with those transferring genetic material. In what ways and with how much effect these measures will be implemented, only time can tell.

While national initiatives are important to regulate the access to genetic resources, regional cooperation in this regard is equally important, as neighbouring countries may share a considerable part of their biodiversity. Without harmonized legislation of access to biodiversity, developing nations will be induced by foreign interests to enter into competitive tendering

of common resources, further diminishing the returns that can be obtained by each of them. For instance, the species *Taxus baccata*, with potential anti-cancer properties, is shared by the Himalayan range countries. If India puts up a price for access to this species, other countries may undercut this price in an effort to corner the profits. Together, these countries can get a better price, since the species is not found outside the region.

An interesting example of such regional cooperation is the Andean pact, in which many South American countries have pledged to harmonize their individual biodiversity laws, by adopting common guidelines and rules for access agreements. The pact also stipulates a fund for genetic resource conservation, which is to be fed by a nominal set percentage of financial benefits from all approved access agreements in member states, and other contributions, including voluntary contributions from member or non-member states.

The Indian Ministry of Environment and Forests also organized a meeting of Asian countries to discuss regional cooperation on matters related to biodiversity, which was hosted by the Indian government in August 1994. It was attended by countries of south, south-east, and north Asian regions, and non-governmental delegates. A number of follow-up actions on scientific and technical cooperation, joint conservation programmes, information exchange, and other aspects were planned. However, at the time of writing, more than a year later, no follow-up has been carried out.

As pointed out in the next chapter, national and regional actions have to go hand in hand with international actions. In particular, the provisions of the Biodiversity Convention which state that access will be on "mutually agreed terms" and with "prior informed consent", need to be elaborated, with clear and comprehensive definitions of these two phrases.

REGULATING LOCAL ACCESS

As thorny as international access regimes is the issue of how and to what extent local communities should be empowered to

regulate access to the resources and knowledge which they hold. Any form of monopoly here would be as unacceptable as monopoly by the corporate world, or by countries. On the other hand, a free access regime does not ensure that local communities are respected and rewarded for their innovations.

Various suggestions have been made, including a system of taking the consent of the community before transfering their resources/knowledge (as required by the Biodiversity Convention; see next chapter), and of building up mutually agreed terms of transfer. It may not be wise to allow direct linkages between foreign or national companies and the communities; perhaps some governmental or independent intermediary would be needed. The Philippines presidential order mentioned above regulates not only international transfers, but also collections within the country. It provides for considerable local community say in these collections. The draft principles for an act on biodiversity, currently being considered by the Government of India, also contains provisions for such regulation.

In India, a large-scale ground level effort is currently underway, to document local community knowledge regarding resources and resource uses, in the form of community registers. The idea is to assist communities to document what so far has been part of oral tradition. The objectives are manifold: the exchange of ideas between communities, the revitalization of local knowledge systems and local pride in such systems, and protection against intellectual 'piracy' by outsiders. This last objective can only be met, of course, if there is complete community control over the registers; these documents should not become accessible to the industrial world, unless the community so desires.

In 1995, a draft format for the community register was tried out in several locations in India, following which weaknesses in the format and methodology are being plugged. In 1996-97, the exercise is to be carried out in over 50 village clusters spread over several states.

While such arrangements on the ground are crucial, the national and international regimes of material transfer, and of

IPRs, must also incorporate local community interests. One suggestion, for instance, is that patent offices must insist on knowing where a material was collected from, along with proof on whether or not relevant national and international rules were followed. An **international certificate regime** could be established, according to which persons claiming IPRs must certify that the use of traditional knowledge or resources, for the development of the relevant product or process, was with the informed consent of the original holder(s), and that fair and equitable compensation was given/guaranteed. Provision for such a system and appropriate enforcement procedures can be included in a protocol to the convention; see next chapter.

Another interesting suggestion has come from a series of consultations held in different parts of the world, relating to the informal sector of farmers, traditional healers, and other local community agents who maintain or develop domesticated biodiversity. The main position of those advocating such an Informal Innovation System (IIS) is that:

1. Farmer landraces, plants in use for medicinal purposes, other biological products and processes in use, and other innovations in use (including those relevant to industrial patents, trademarks, design or copyright) are the result of human ingenuity and represent immediate inventions (or discoveries);

2. Most of these inventions/discoveries are not the product of academic or commercial research but arise from "informal" (often cooperative) efforts which are as purposeful and creative as any similar efforts in more formal or "western" models of innovation;

3. Crop plant collectors gather present-day, improved germplasm (not the material of ten thousand years ago). Botanists collect both medicinal plants and landraces and the knowledge (or "intellectual property") of those who have bred, discovered, and protected the genetic material. In each case, the present intellectual integrity of the informal innovation system is compromised by the existing

model of intellectual property rights which offers no recognition or compensation."[1]

Various community rights regimes have been proposed at international and national levels. Darrell Posey of the Traditional Resource Rights (TRR) Programme, has suggested TRR as a bundle of rights which protect, conserve, and compensate for the knowledge and resources of local communities.[2] Gurdial Singh Nijar of the Third World Network has proposed a Community Intellectual Rights Act, which is based on very different premises from current IPRs: it recognizes the collective nature of knowledge, its past heritage and dynamic properties over time, and its usefulness/innovativeness not just for industrial purposes but for its social, domestic, or ecological values also.[3] The Genetic Resources Action International (GRAIN), a group which has been advocating farmers' rights issues, has put various different positions together and recommended a regime based on the principles of **heritage** ("everything that belongs to the distinct identity of a people and which is theirs to share, if they wish, with other people", as defined by the UN Economic and Social Council), **territoriality** ("the right of ownership, collective or individual, of the members of the population concerned over the lands which these populations traditionally occupy", as defined by the International Labour Organisation's Convention 169), and **communal rights** (collective ownership of a community, as distinct from private ownership). GRAIN argues that this regime could form a powerful alternative to current IPR systems, which are based on private monopolies.[4]

In the Indian context, some farmers' groups have recently asserted their "Common Intellectual Property Rights" (CIPRs), a concept which incorporates many of the points above.[5] This recalls an interesting ongoing debate, recently fueled by the announcement that a professor from Ahmedabad is going to help Indian farmers obtain U.S. patents for their innovations; this debate is explored in the last section in this chapter.

EQUITABLE SHARING OF BENEFITS

Once the principle of equitable sharing of benefits arising out of the use of biodiversity is accepted, both *between* countries, and *within* a country between communities/classes, the main question is: how?

This is a tricky issue, especially since genetic resources are not easily 'costed.' The monetary value of a wild plant, for instance, can reflect (a) the market value of the raw material as used by a local community for domestic purposes, (b) the collection and preservation costs, (c) the cost of the material at various points along the way to its final sale, (d) the current commercial value of finished products derived from the material, (e) the potential future commercial benefits which might accrue, and others. All but the most fair-minded of commercial users would opt for giving a return which tends to option (a) rather than option (e). What is 'equitable' in this is difficult to decide, and almost always a community or country of origin will have a different interpretation from the recipient country or company. Other problems include the difficulty in deciding *who* the benefits should go to (individuals, families, community-level leaders, NGOs claiming to represent communities, governments, etc.), *how* they should be disbursed (outright royalties, development inputs, technical know-how, other returns in cash or in kind), and so on.

A number of possibilities for generating returns (both in cash and in kind) have been suggested:[6]

1. *Charging collection fees*: At the time of collection, the community or country can charge appropriate fees. However, the determination of fees is difficult, especially given the uncertainties regarding the potential future value of the genetic material being collected. The current value of many resources may be low or nil, and it is obviously difficult to predict its future use. Also, the institutional mechanisms for ensuring the payment of fees are difficult to establish. However, some communities have learnt from past experience, and have begun to charge accordingly. In Peru, for example, some local communities charge as much

as US $2000 per potato to collectors! They have an effective system of checking outsiders at the exit points. Philippines has instituted certain rules for collection, within the presidential order mentioned above, including obtaining the consent of local communities. In most other cases, however, collection fees are likely to be a rather difficult and uncertain arrangement.

2. *Paying for the past and present,* by pricing traditional knowledge which already has current commercial value. For instance, in the case of nuts and fruits, almost all of which were first used by indigenous communities, the current market value could be assessed, their origins determined, and appropriate compensation paid to local communities or countries. The same could be for medicinal plants which are in use by allopathy, many of which are derived from uses in traditional systems. Such retrospective royalties would, however, be very difficult, perhaps impossible, to extract from the industrial countries and private corporations. The only exception in the near future may be some progressive countries, like those in Scandinavia, who are considering the creation of funds in recognition of the past contribution of tropical countries. In India, the Tropical Botanic Garden and Research Institute (TBGRI), in Kerala, has taken an interesting initiative: it has decided that royalties arising out of drugs based on a lead provided by tribals, would be split in some fixed ratio between the institute, the researchers, and the tribals.
3. *Fixed royalties:* A certain percentage of profits can be committed as royalty payments to the country/community of origin of the material. An example is the deal between the pharmaceutical giant Merck, and a Costa Rican NGO InBio, in which Merck has committed to paying a fixed (but publicly undisclosed) royalty for every product it develops out of the genetic material which InBio is collecting, screening, and giving it from the forests of Costa Rica. Again, this is difficult to enforce if the recipient company wants to play truant; however, in cases of genuine transactions, this could be valuable. The TBGRI

arrangement cited above is also an example of royalty payments.

4. *Rewards:* By rewarding farmers through fairs and competitions, which would help determine the value of their innovations and ideas relevant to biodiversity, and provide incentives to farmers who maintain high diversity in their fields. Prof. Anil Gupta of the Indian Institute of Management, Ahmedabad, cites the example of an all India cattle fair in 1956, in which prizes were given to the best cows of various breeds, but notes that such initiatives have declined since the inception of mass cross-breeding programmes under Operation Flood and other foreign-funded projects.
5. *Financial support*: A number of possible avenues for financial support exist. International insurance companies can underwrite the premium obligation, through national companies, for traditional communities who maintain biodiverse farming systems. In addition, national credit systems could be extended to such systems. This will help to subsidize the biodiverse systems which may otherwise, in the context of modern farming techniques, often remain out of the formal banking system (as suggested in Chapter 3). Other ways of generating finances would be through an international and national taxation on the pharmaceutical, seed, and other biodiversity-based industry; the Rural Advancement Foundation International estimates that a tax which is roughly about the same as a normal royalty charge often paid by industries on products, would amount to "several billions of dollars per annum."[7]
6. *Development and resource regeneration inputs*: Communities who have excelled in biodiversity conservation, development, and knowledge, could be given special inputs of appropriate development projects, and programmes for regenerating natural resources. It is vital that such inputs be socially and ecologically sensitive, building on rather than displacing local social, cultural, economic, and technological systems.
7. *Capacity enhancement*: Relatively minor changes in local

skills and technologies can sometimes help in generating improved livelihoods and incomes. In India, this is especially being considered in the context of medicinal plants, and other non-timber forest produce. In the Biligiri Rangaswamy Hills of southern Karnataka, for instance, local groups are helping tribals to switch from selling the raw materials for the famous Ayurvedic medicine Trifala, to processing these materials into some intermediary from so that they can get a better price.

8. *Exemption from the application of IPRs*: This could be in the form of a system of automatic licensing rights, without royalty payments, to Third World countries for all patents of materials derived from their biodiversity. In other words, if a company derives a pharmaceutically important product from a plant obtained from India, Indians should be exempted from having to pay royalties on its use. Actually, one should even insist that Third World exemption from the working of IPRs should be extended to all genetic material and biotechnologies, in recognition of the fact that the formal sector in the west has a heavy past debt to the innovations made in the informal sector. Though a remote possibility, it may be possible to take steps towards such an arrangement under various provisions of the Biodiversity Convention; see next chapter.
9. *Full access to and repatriation from gene banks*: While in theory farmers and countries do have access to national and international gene banks, in practice this is often difficult. There needs to be an active programme of informing farmers of the material stored in these banks, of repatriating such material to the country and community of origin, and of supporting the re- establishment of diversity in-situ conditions.
10. *Local community rights*: Recognizing local community rights over common pastures, forests, and waterbodies, would be a powerful incentive to these communities to conserve. In India, this would reverse the alienation that has been caused by a century of policies and laws on common property, which have emphasized state control at the

expense of local community control (see Chapter 2, on forests as an example).

CAN WESTERN MODELS HELP INDIA'S POOR?

The Merck-InBio deal cited above, in which the biological resources of Costa Rica are made available to Merck through the NGO InBio for a one-time collection fee and an ongoing royalty payment, is just one of a growing number of arrangements which are called "bioprospecting."[8] Others involve both public and private sector agencies. There are a number of attractive aspects of the Merck-InBio deal which were not present in earlier transfers of genetic resources from the tropics to the industrial countries: guaranteed royalty payments, national capacity enhancement in pharmaceuticals, commitment towards channelizing some benefits back to conservation. However, serious concerns have been raised about a number of other aspects: the possible run-away commercialization of biodiversity components, and the fact that Merck is under no obligation to make easily accessible the products derived from Costa Rica's resources, or indeed not to patent them. This last point has the same ethical, social, and biological implications outlined above in respect to IPRs on life forms. Finally, the repayment of royalties from Merck's patents or the sales of its products, to InBio, is completely dependent on the honesty and goodwill of the corporation. In the event of a dispute on the origins of a plant-derived active ingredient—for example, if Merck claims that the origin is Nicaraguan and not Costa Rican—both InBio and Costa Rica would be at a great disadvantage trying to prove their rights.

InBio is sending out "parataxonomists", young educated people who are given short courses in identification and collecting methods, to collect large numbers of samples from specified forest areas... including, for instance, 100,000 insects per month.[9] The moral dilemmas and ecological dangers of this kind of exploitation, remain outstanding issues.

These concerns are present with all bioprospecting deals.

Several groups are trying to draft more 'equitable' deals which involve local communities and which are sensitive to ethical and social issues. But the basic issue of viewing biodiversity as primarily a commercial resource, rather than as one which is worth preserving in its own right and as a daily life-support system for the world's poor people, will remain a fundamental problem with all such deals.

Such dilemmas also face another growing demand, that of patenting the innovations of the informal sector also. It has been argued (e.g. by Prof. Anil Gupta of the Indian Institute of Management, Ahmedabad), that IPRs should be used by local communities to protect their knowledge and resources. In theory, this is at least to some extent possible. For instance, a traditional healer who has discovered a novel use of a plant-based compound, could be granted a patent for that use under most systems of patent protection. A farmer who breeds a new variety of crop may also be eligible to apply for Plant Breeders' Rights. Simultaneously, in theory a compound or product or process which is being used by a large number of people, which is in other words in public knowledge, would not be patentable.

There are, however, a number of problems with this approach. The ethical and ecological issues relating to patenting and commercialization remain as valid in the case of the informal sector as in the formal sector: there is in this sense little difference between Agracetus corporation and an individual farmer. Secondly, much (though not all) of the knowledge and resources held by local communities is common property, not individually owned. Patenting by individual families or even villages could cause severe social disruption and discontent. Third, the obtaining of IPRs is an expensive process, which may therefore be accessible only to large farmers and other well-to-do rural people. Fourth, applying for an IPR may in many cases not be financially viable, since crop and livestock varieties adapted to micro-situations would have too restricted an applicability to make the expense of obtaining an IPR worth it. Finally, if a right holder cannot identify the violation of the patent/PBR, and be capable of challenging the violator, the right remains on paper. Small farmers or tribal healers in India would probably never get

to know of such infringements, and even if they did, would hardly be in the position to challenge powerful corporations who may have "stolen" their intellectual property. Independent NGOs and individuals may bail them out in such a situation (e.g. Prof. Gupta is helping farmers obtain patents for their agricultural innovations, and has pledged to support any legal battles which might ensue), but this would be difficult to sustain on a large scale, and would in any case create new dependencies.

Finally, an argument gaining ground is that India must rapidly expand its biotechnology base, so as to make full use of its biodiversity, and become competitive with other countries rather than remain dependent on them. This argument is fueled by the strong belief that biotechnology is the future answer to the world's agricultural and health problems.

This is not the place to review the pros and cons of biotechnology (or rather, its modern genetic engineering variant, since even making curd could be called biotechnology!). It must, however, be stressed that proponents of biotechnology as a panacea continue to miss the fundamental point, that problems of hunger, etc. are not caused by inappropriate technologies as much as by socio-political forces. In so far as biotechnology cannot tackle these forces, and therefore become another sophisticated tool for the rich and powerful to get richer and more powerful, a strong word of caution is warranted.

What I would also like to stress is that even if there is considerable scope for biotechnology to solve our technology-related problems, simply aping the developments of the industrialized nations is not necessarily going to help. Genetic engineering is expensive and so highly specialized that only a few can understand it. It will by and large be inaccesible to farmers and local communities, and will therefore create a greater dependence on the governmental and corporate structure than even the current models of Green Revolution and allopathy.

However, there is considerable scope for learning from modern biotechnology, so long as we are clear that we will pick up only that which is in consonance with our basic environmental, social, and cultural values. But as argued in Chapter 3, greater attention on indigenous resources, skills,

knowledge, and practices could yield far more sustainable results, and we may actually have to use very little of modern biotechnology. As an example, the Foundation for Revitalisation of Local Health Traditions (FRLHT) points out that the utilization of medicinal plants is already very sophisticated in India; in its original form, or with some technical enhancements, the tribal, ayurvedic, and other indigenous health systems could provide the world with medicine (rather than raw plant material, which is currently going out). And as argued above, capacity enhancement based on local skills and knowledge, e.g. again in the field of medicinal plants or other non-timber produce, could greatly help local communities in getting fair returns for their resources and knowledge.

CONCLUSION

The conservation of biodiversity is obviously not a simple task of protecting some plants and animals; as we have seen above, it is impregnated with the politics of the relations between and within countries. How these politics will work out over the next few years will decide whether some of the inequalities which mark human relations will increase or decrease. The tendency to monopolize the benefits of using biodiversity, so starkly displayed in the world of intellectual property rights, threatens to increase the inequalities, and also to jeopardize the maintenance of biodiversity.

But there are also encouraging forces militating against such a tendency. At a national level, these forces are represented by strong people's movements, NGOs and individuals with concrete legal and policy alternatives, and a resurgence of the rights of local people. At an international level too, recent events related to the Earth Summit and its aftermath offer some promise, as explored in the next chapter.

6

The Biodiversity Convention and India

On 29 December, 1993, there came into force an international treaty of far-reaching significance for the future of humanity's troubled relationship with the earth: the Convention on Biological Diversity.[1] For both international relations and domestic policies within each country, this treaty (henceforth called the convention) has interesting implications. An understanding of these implications could help to transform what is simply a piece of paper, into actual action.

International efforts at conserving life forms are not new. There are over 150 bilateral, multilateral, and global treaties on the environment. Many of these deal with various aspects and parts of biodiversity, starting with the Convention Relating to the Preservation of Fauna and Flora in Their Natural State, 1933. But most of these are specific and sectoral in nature; for long there have been discussions on the need for a unifying and comprehensive treaty.

Discussion on such a global agreement began at various forums, such as the United Nations Environment Programme (UNEP), in the mid-1980s. In 1988, UNEP set up an Ad Hoc Working Group of Experts on Biological Diversity to look into the matter. Based on its report, UNEP entrusted an Ad Hoc Working Group of Legal and Technical Experts to work out a legal document. In 1991, this group was renamed the Inter-Governmental Negotiating Committee (INC), a body with equal representation for each country. The INC hammered out the convention by 1992, making it ready for governments to sign

at the Earth Summit in Rio de Janeiro, Brazil. At that meeting, the convention was signed by almost every country on earth. By early 1996, it had been ratified by over 140 nations, signalling their readiness to abide by its provisions. With the 30th ratification on 29 December 1993, the convention entered into force as international law.

The convention contains about 40 articles. The first few articles deal with general principles, definitions, and objectives, and the last several deal with implementation details. The substantial parts, articles 5 to 17, deal with various aspects of biodiversity: identification and monitoring, conservation in natural or human-modified surroundings, rational or sustainable use, creation of awareness, impact assessments of activities likely to affect biodiversity, access to genetic material, safeguarding of relevant traditional knowledge and practices, sharing of benefits of biological resource use, and exchange of information and technology between countries. Indeed, what makes this treaty especially significant is that it goes far beyond the scientific aspects of biodiversity conservation into the realm of national and international politics.

Three broad thrusts permeate the convention:

- the conservation of biological diversity;
- the sustainable use of biological resources; and
- the equitable sharing of the benefits of such use.

CONSERVATION AND SUSTAINABLE USE

As befits any treaty on biodiversity, a considerable part of the CBD is devoted to issues of conservation, and linked up to these are aspects of sustainable use. For the first time in human history, an agreement has been reached to conserve the entire range of biodiversity (at ecosystem, species, and genetic levels; see Chapter 1). The convention recognizes, however, that it may not be possible to conserve everything; it therefore calls for identification and monitoring of important biodiversity components, and activities which have negative effects on them. It lays stress on *in situ* conservation through protected areas,

action against factors destroying biodiversity, restoration of habitats and species, and control of alien species. It also calls for the adoption of *ex situ* conservation measures.

All this is, of course, far easier said than done, for if it is to be achieved, it will call for a change in our conservation policies (away from single-species or megafauna focus to a stress on diversity, and away from centralized bureaucratic controls to local community or joint management systems), as also a drastic change in our development policies. As elaborated in the earlier chapters, the growing tendency to look at natural resources basically as arenas of profiteering will have to be challenged.

The convention commits countries to "develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes...." Even prior to the Earth Summit, the Indian government had formulated a National Conservation Strategy and Policy Statement on Environment and Development.[2] While most of this document is directly or indirectly relevant to biodiversity, the specific action points on biodiversity are very brief. There is obviously a need to build up a much more detailed strategy. One step towards this is the recent commissioning of a comprehensive status report on Indian biodiversity by the Ministry of Environment and Forests (MoEF), an exercise which is currently underway at the Indian Institute of Public Administration. Another step is the ongoing drafting of a national biodiversity action plan, also initiated by the MoEF.

It is becoming increasingly evident that the roots of biodiversity destruction lie in the relations between communities within each nation, and between the nations of the world. It is these relations which corner and manage the vast majority of biological resources for the benefit of a small minority elite within poor nations, and for the wasteful consumption patterns of the North. Development paths and projects are geared to cater to this pattern, and it is not therefore surprising that they are extremely destructive of biodiversity. We have already seen how this operates in the case of natural habitats (Chapter 2) and agricultural lands (Chapter 3).

Unfortunately, the Biodiversity Convention does not tackle these issues head-on, but there are underlying implications in its weakly worded text which can be brought out:

- Article 6 commits countries to "integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies;"
- Article 10 commits them to "integrate consideration of the conservation and sustainable use of biological resources into national decision making;" and
- Article 14 requires that they "introduce appropriate procedures requiring environmental impact assessment of its proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects."

Countries are, however, required to do all this only "as far as possible and as appropriate", which gives them the freedom to do nothing at all! Unless, of course, they are forced to.

In India, citizens' groups have started mounting pressure on the government for a thorough review of national developmental policies to make them sensitive to biodiversity conservation concerns. Mass movements like those against big dams, mechanized trawlers, intensive prawn-shrimp farming, and seed corporations, are forcing upon everyone the realization that something is terribly wrong with the current development process. The Central Ministry of Environment and Forests appears willing to facilitate such an exercise, but it will require an uphill and long-drawn struggle to get other sectors of the government to change. What is most critically needed is a review of the recent economic changes in India, which are already proving environmentally destructive.

The precise impact of development policies and projects on biodiversity are not well-studied in India, but this would become necessary for Environmental Impact Assessment (EIA) if the country was committed to following Article 14 of the convention. India already has in place a system of EIAs for development projects. But the EIA criteria do not have biodiversity as a specific concern, though the impact on wildlife is supposed to be

looked into. A comprehensive EIA notification has recently been issued by the government, but this still lacks guidelines which incorporate biodiversity indices and measures.

In agriculture, the convention may be able to bring attention to the need for revival of on-farm biodiversity, though the main text does not have many specific references to this. In the negotiating process, it took a great deal of persuasion by some governments and NGOs, to get delegates to accept agro-diversity within the definition of biodiversity. Though the idea found acceptance, it did not evoke enough response for any major thrust to be put into the convention. However, the portions on local community knowledge (quoted above), along with the following, could be used:

> "Establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology..." (Article 8(g));
>
> "Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats, or species" (Article 8(h));
>
> "Protect and encourage the customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements" (Article 10(c));
>
> "Adopt economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity" (Article 11).

This last clause is important, for financial and economic incentives will certainly be necessary to encourage farmers to retain their traditional crop and livestock varieties, foregoing in the process the greater short-term gains of modern 'improved' varieties.

Apart from this, the convention process also included a unanimous resolution, passed in 1992, on agricultural biodiversity. This resolution not only called for conservation, but

also for clarification on the vexed issues of ownership of international gene banks, and on farmers' rights. On the former, the potential power of the convention was dramatically illustrated in 1994 when, during an inter-governmental meeting, NGOs highlighted the threat of the World Bank taking over control of international gene banks. Several governments, especially from the tropics, which had contributed much of the material for these gene banks, were aghast; there were a series of statements condemning the World Bank, which subsequently withdrew its attempts!

It is critical that *in situ* conservation of crops and livestock on farmers' fields, the acceptance of farmers' rights and farmers' participation in biodiversity conservation, are guaranteed in the convention itself. The seeds of these are already in the text and in the associated resolution, and it is now up to citizens' groups to ensure their wider interpretation, or their expansion into appropriate protocols.

But while elements of the convention can be used for integrating biodiversity concerns into national planning, there is in the convention no mention whatsoever of global consumption patterns, terms of trade, and other international roots of the biodiversity crisis. A clause in an earlier draft which committed countries to "take into account the effect of... international trade policies" was dropped in the last round of negotiations. The countries of the South, and peoples' organizations all over the world, must demand a commitment from the North towards a drastic restructuring of the world economy, and of far-reaching structural adjustments within Northern economies to make them globally sustainable. Unfortunately, India, which was till recently in a strong position to lead the Third World in such a crusade, has of late relinquished this position by trying to join the international economic bandwagon, in the process opening itself to the manipulative control exercised by the IMF and World Bank.

EQUITABLE SHARING OF BENEFITS

There are several clauses in the Biodiversity Convention

concerning the sharing of benefits relating to the utilization of biodiversity, including both financial and technological benefits. In theory, some of these could be used, both internationally and domestically, for reversing historical inequalities. These provisions are:

1. The principle of national sovereignty over biological resources in the Preamble, Article 3, and Article 15. This would imply that each country has the right to define the kinds of access that others have to its biological resources, and the kinds of returns it expects in turn for such access... just like it has always had for minerals and other natural resources. It will require appropriate legal and other measures for each country to be able to meaningfully enforce this principle. Two such measures are in related provisions, given below.
2. The related clause, in Article 15(5), that "Access to genetic resources shall be subject to prior informed consent of the Contracting party providing such resources." There is a need to introduce measures which require applicants for patents to provide proof that the biological material in respect of which intellectual property rights are being sought by them were legally acquired. The requirement for prior consent implies that a country or company taking genetic resources should be considered to have taken it illegally, if it has not been consented to by the country of origin.

   For that requirement to be given effect, each country needs to enact a prohibition on other countries' access to its genetic resources without prior approval. At the same time, the recipient country should enact legislation stating that access to and importation of genetic resources without a license from the country of origin, is illegal. These two processes will have to be simultaneous.
3. The clause, in Article 15(4) states that "access, where granted, shall be on mutually agreed terms" This will require appropriate legal and other measures in each country, including regulations governing the collection of biological resources. Model contracts between collectors,

national authorities and suppliers of biological resources will need to be developed, which can help ensure that the exchange of biological resources generates immediate as well as long-term benefits for the countries containing the resources. The latter issue, of long-term benefits, is important, for it will require work on the potential future value of a genetic resource being taken now, and modes of following up on such future utilization.

4. Clauses recognizing the role of traditional communities in the conservation of biodiversity, especially the preamble, regarding the

> "the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components."

Further, Article 8(j) states that each signatory country will,

> "subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices."

Three important thrusts are present in the above: respect for traditional systems, seeking their consent for the wider use of these systems, and ensuring that the resulting benefits are shared equitably with them. Following up on these will again require legal, administrative, and institutional arrangements, with full participation of local communities at all stages of decision-making.

Some possible ways of taking the above steps have already been discussed in Chapter 5.

5. The links established, in Article 16, between the supply of genetic resources (by tropical to industrial countries) and access to and transfer of technology (in the reverse flow), which makes use of those resources. This link can be utilized to enable the suppliers of biological resources on the one hand and suppliers of sources of technology on the other to benefit from collaborative ventures. However, the convention is also rather ambiguous regarding technologies protected under existing IPR regimes (see below), and future interpretations of the relevant provisions, as also the power of countries to enforce their own interpretations, which will determine the actual level of access. On the other hand, the relevance of each technology to the conservation and sustainable use of biodiversity needs to be carefully assessed in technology transfer arrangements, with special attention to the need to build on indigenous technologies and prior knowledge. Such technology assessments should take into account the impacts of technological developments upon biological resources.

INTELLECTUAL PROPERTY RIGHTS

The convention gives a glimmer of hope of reversing the trend towards patenting life forms and biotechnologies. In the provisions relating to the transfer of technologies "that are relevant to the conservation and sustainable use of biological diversity or make use of genetic resources and do not cause significant damage to the environment" (Article 16), there is a condition, by which:

> "In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights."

However, this is followed by a counter-point:

> "The Contracting Parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of the present Convention, shall cooperate in this regard subject to national legislation and international law, in order to ensure that such rights are supportive of and do not run counter to the objectives of this Convention."

The formulation is weakly and unclearly worded, especially because of the caveat "subject to national legislation." Nevertheless, if Southern countries and citizens' groups worldwide can maintain pressure for its suitable interpretation, and clearly show that IPRs work against the interest of biodiversity conservation and equitable sharing of benefits, then this clause could well work to their advantage. In 1995, parties to the convention agreed to study the relationship between IPRs and biodiversity, and between the convention and GATT. Indeed, one demand that should continue to be made is to subject the relevant negotiations under GATT and other forums to the overall objectives of the Biodiversity Convention. Clause 3(b) of Section 5 of the Dunkel Draft, on the patentability of plants (discussed in the previous chapter), should then stand revoked. Perhaps Article 22(1) of the convention can be used; this article implies that other international agreements can be called to question if they involve "serious damage or threat to biological diversity."

The disciplining of the powerful private corporate sector too is critical here. Just like Southern nations are being asked to negotiate resources over which local communities have traditional rights, Northern countries should be able to negotiate on behalf of their private sector. Northern governments are however, repeatedly stating that a number of formulations relating to patents, technology transfer, etc. are not negotiable since these are in the hands of the private sector. This is unacceptable, particularly since there is not much that private companies could have done in this field without governmental support, especially in terms of opening out access in Southern

countries on the one hand while pursuing protectionist policies on the other. The convention, in Article 16(4), states that:

> "Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, with the aim that the private sector facilitates access to, joint development and transfer of technology... for the benefit of both governmental institutions and the private sector of developing countries."

Again, this weak formulation provides a base on which to build. Indeed, the Biodiversity Convention could become one of the South's few effective weapons against the increasingly monopolistic and North-dominated international trade regime being currently propagated, a regime which economically-indebted nations like India are finding hard to resist. The South's biological resources are its greatest assets, and can be used as a bargaining lever in a world which is otherwise so heavily stacked against it. But to do this will require an unprecedented show of solidarity among the gene-rich nations of the world.

THE HAZARDS OF BIOTECHNOLOGY

An increasing amount of evidence is surfacing to show that the picture of biotechnology as humanity's saviour is seriously flawed, its exciting potential being tempered by its capacity to induce biodiversity erosion, environmental and health damage, and greater economic and social inequality within and among nations.[3] The convention is weak in this respect. Repeatedly, during the convention negotiations, there were attempts by people's groups to get delegates to propose a separate article on safety in the development and use of biotechnologies. These moves were resisted by most delegations. The result is that the convention comes out sounding somewhat positive about biotechnology, but with some caution built in.

Article 8(g) commits countries to

"establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental effects that could affect the conservation and sustainable use of biological diversity, taking also into account the risks to human health."

Article 19(3) suggests that:

"the Parties shall consider the need for and modalities of a protocol setting out appropriate procedures including, in particular, advance informed agreement, in the field of the safe transfer, handling and use of any living modified organism resulting from biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity."

In late 1995, after several rounds of discussions, parties to the convention finally agreed to formulate a biosafety protocol. Pressure from Third World countries, which are increasingly becoming the testing or dumping grounds of potentially hazardous biotechnologies, along with lobbying by NGOs, will be needed to make the protocol comprehensive and effective.

India, incidentally, already has regulations regarding genetically manipulated organisms,[4] under its Environment Protection Act of 1986. These rules lay down procedures for environmental impact clearances, and for the periodic checking of premises and processes handling genetically manipulated organisms. Central authorities have been set up under these regulations, including a Review Committee on Genetic Manipulation under the Department of Biotechnology, which is supposed to "monitor the safety related aspect in respect of on-going research projects and activities involving genetically engineered organisms/hazardous micro-organisms, GMOs or cells." A Genetic Engineering Approval Committee is to function under the Ministry of Environment and Forests, "for approval of activities involving large-scale use involving over 20 litres of hazardous micro-organisms, GMOs or cells in research and

industrial production from the environmental angle", and "for environmental clearance of proposals relating to release of GMOs and products into the environment including experimental field trials involving more than 10 litres culture volume."

TAKING LEGAL STEPS

Also as a part of the review of India's state of preparedness regarding biodiversity conservation, an extensive survey was conducted of relevant national legislation.[5] In an assessment of over 40 central acts, it was found that while aspects like "in situ" conservation of and trade in wild flora and fauna were well covered, serious legal gaps existed with respect to the conservation of domesticated biodiversity, restrictions on the introduction of exotics, and appropriate sharing of benefits of biodiversity use. Appendix 4 provides a summary of the results.

Subsequent to the signing of the convention, a review has also been done of the status of legal instruments available in India to enforce its various clauses.[6] This analysis shows that of the 80 action points emanating from the convention, about 45 would require appropriate legal measures. Of these 45, as many as 28 have no legal backing, including the following: ensuring fair and equitable sharing of the benefits of genetic resources (Article 1), integration of biodiversity conservation into sectoral and cross-sectoral plans, programmes and policies (Article 6(b)), respecting and preserving relevant traditional knowledge, practices, and uses (Article 8(j) and 10(c)), regulating activities having significant adverse effects on biodiversity (Article 8(1)), introducing EIAs of projects with possible impacts on biodiversity (Article 14(1)(a)), notifying other countries of activities having potential impacts on their biodiversity (Articles 14(1)(c) and 14(1)(d)), ensuring appropriate access to biological resources and biotechnologies (Articles 15(2) and 16), and providing information on GMOs to countries where these GMOs are proposed to be introduced (Article 19(4)).

The Government of India has now been urged by several research and activist groups to identify ways and means of

plugging some of the major legal gaps identified, both to ensure biodiversity conservation within India and to fulfill the obligations under the convention. The Ministry of Environment and Forests is actively considering a separate, overarching legislation on biodiversity. There are obvious difficulties and dilemmas involved: how does one deal with both wild and domesticated biodiversity in a single act? How does one legislate meaningful measures in the absence of even a basic knowledge of biodiversity among the concerned personnel, including the judiciary? What happens to the existing Indian Wildlife (Protection) Act of 1972? What about aspects of land-use and resource management which are the domain of state governments? These and many other questions will have to dealt with before a separate act can be decided on; meanwhile, plugging gaps in existing legislation is likely to be the major thrust.

A CONSULTATIVE PROCESS

The initial stages of the convention were marked by an absence of public debate in most countries, and a rather thin attendance by NGOs at the inter-governmental meetings. It should be incumbent upon any government which is going to negotiate an international treaty, to conduct a process of wideranging consultation with its citizens. In India, there was no debate whatsoever, with even most conservation groups remaining unaware of the range and implications of the issues covered by the convention. Undoubtedly, there could have been far greater pressure to incorporate or strengthen some of the aspects mentioned above, had there been greater public involvement.

One direct result of this non-consultative process is the almost total silence of the convention text on the need to involve the non-governmental sector in biodiversity conservation. Even the subsidiary Body on Scientific, Technical and Technological Advice (Article 25) is to consist only of government representatives. This is an extraordinary and glaring lapse,

especially since we are in the midst of increasing international realization of the role of citizens in environmental protection.

However, very soon after the convention was signed at Rio, citizens' groups across the world realized its potential and implications. From a total of 6-7 groups which attended the negotiating process, the first Conference of Parties in late 1994 had well over 100, and the second in late 1995, over 300. And they were very vocal indeed, accosting delegates in corridors, voicing their opinions in the main sessions, bringing out newsletters packed with views and information, and spreading as much material as possible. They have even had notable successes, as in the case of the World Bank and international gene banks, mentioned above. Indeed, many delegates have become used to getting intelligent inputs from the NGOs, on the basis of which they can formulate their own official position.

Nevertheless, within each country, and this can certainly be said of India, the process of public consultation has hardly begun (Appendix 5 presents a list of some NGOs/persons working on the convention). Each government should immediately start a dialogue, with its citizens, on issues relating to the convention. Some tentative steps have been taken in India in this direction. National level consultations have been held on the follow-up to the convention, and a committee set up by the Ministry of Environment and Forests to suggest relevant actions. The goal of making biodiversity conservation an effective movement, however, needs much more than some meetings and committees. The dialogue should include not only academics, environmentalists, scientists, and social activists, but also, and most importantly, representatives of local communities which are closest to the biodiversity that is sought to be conserved. Local language translations must be available, and communities must be able to discuss the implications of various provisions with NGOs and government officers. Such a process will be the first step towards ensuring that the potential of the convention, to conserve biological diversity and benefit the majority of people, does not remain merely on paper.

Appendices

APPENDIX 1
WILD BIODIVERSITY OF INDIA

There is considerable variance in textbooks on the division of living kingdoms. The classification below is adapted from relevant texts of the United Nations Environment Programme and the World Conservation Monitoring Centre.[1]

These tables are adapted from the draft of *Conservation of Biological Diversity in India*, a report under finalization at the Indian Institute of Public Administration, under sponsorship of the Ministry of Environment and Forests, Government of India. The data presented are provisional, and may not be conclusive.

Table 1: Plants and related micro-organisms[2]

Kingdom/ major division	*Common name*	*No. of species in India*	*No. of species in the world*	*Share of India in world (%)*
Monera				
Bacteria	Bacteria	850	3060	27.78
Cyanophycota	Blue-green algae	300	1700	17.65
Fungi				
Acrasiomycota/ Myxomycota	Cellular/plasmodial slime moulds	450	513	87.72
Chytridiomycota	Chytrids	250	575	43.48
Oomycota	Water moulds	300	580	51.72
Zygomycota	Zygomycete fungi	280	665	42.11
Ascomycota	Cup/lichen fungi	3000	28650	10.47
Basidiomycota	Basidiomycete fungi	3200	16000	20.00
Deuteromycota	Fungi imperfecti	5000	30000	16.67
Algae				
Chlorophyta	Green algae	1200	7000	17.14

Table 1: Plants and related micro-organisms[2]

Kingdom/ major division	*Common name*	*No. of species in India*	*No. of species in the world*	*Share of India in world (%)*
Phacophyta	Brown algae	50	1500	3.34
Rhodophyta	Red algae	100	4000	2.50
Chrysophyta	Chrysophyte algae	300	12500	2.40
Phyrrophyta	Dinoflagellates	6	1100	0.55
Euglenophyta	Euglenoides	20	800	2.50
Lichens	Lichens	1940	13-17000	11.41
Plantae				
Bryophyta	Mosses, liverworts, hornworts	2843	16600	17.13
Psilophyta	Psilopsids	2	9	22.22
Lycopodiophyta	Lycopsids	103	1275	8.08
Equisetophyta	Horsetails (Sphenopsids)	7	15	46.67
Filixophyta	Ferns (Pterropsids)	900	10000	9.00
Gymnosperma	Gymnosperms	64	529	12.10
Dicotolydonae/ Monocotolydonae	Angiosperms	15000	220000	6.82
TOTAL[3]		36165	374071	9.68

Table 2: Animals and related micro-organisms[4]

Kingdom/phylum	*Common name*[5]	*No. of species in India*	*No. of species in world*	*Share of India in world (%)*
Protista	Protozoa	2577	31290	8.24
Animalia				
Porifera	Sponges	516	5100	10.12
Cnidaria (Coelenterata)	Corals, etc.	850	10000	8.50
Ctenophora	Comb-jellies	10	100	10.00
Platyhelminthes	Flatworms	1650	17500	9.42
Nemertinea	Ribbonworms	—	600	—
Mesozoa	—	—	50	—
Gastrotricha	(worms)	88	500	17.60
Rotifera	Rotifers	310	2500	12.40

Table 2: Animals and related micro-organisms[4]

Kingdom/phylum	*Common name*[5]	*No. of species in India*	*No. of species in world*	*Share of India in world (%)*
Kinorhyncha	(worms)	10	99	10.00
Nematoda	Roundworms	2850	25000	11.40
Nematomorpha	—	—	250	—
Acanthocephala	Thornyheaded worms	110	800	13.75
Gnathostomulida	—	—	100	—
Annelida	Worms, leeches	840	12700	6.61
Mollusca	Molluscs (shells)	5050	66535	7.59
Bryozoa (Ectoprocta)	Sea mosses	170	4000	4.25
Entoprocta	—	10	60	16.67
Phoronida	(worms)	3	11	27.27
Brachiopoda	Lampshells	3	300	1.00
Arthropoda	Insects, crustaceans, ticks, spiders, etc.	60383	983744	6.13
Pogonophora	Deep-sea worms	—	80	—
Onychophora	Velvet worms	1	100	1.00
Sipuncula	Peanut worms	38	202	18.81
Echiura	Spoon worms	33	127	25.98
Priapulida	—	—	8	—
Pentastomida	—	—	70	—
Tardigrada	Water bears	30	370	8.10
Chaetognatha	Arrow worms	30	100	30.00
Echinodermata	Starfish, etc.	765	6226	12.28
Hemichordata	Acorn worms, etc.	12	118	10.16
Chordata				
Protochordata	Salps, etc.	116	2173	5.34
Pisces	Fish	2546	21723	11.72
Amphibia	Amphibians	204	5145	3.96
Reptilia	Reptiles	446	5680	7.96
Aves	Birds	1228	9672	12.69
Mammalia	Mammals	372	4629	8.79
TOTAL		81251	1217662	6.67

NOTES

1. United Nations Environment Programme, 1991, Guidelines for Preparation of Country Studies on Costs, Benefits, and Unmet Needs of Biological Diversity Conservation Within the Framework of the Planned Convention on Biological Diversity; World Conservation Monitoring Centre, 1992, *Global Biodiversity: The Status of the Earth's Living Resources*, Chapman and Hall, London.
2. Information on Indian flora is from the following scientists of the Botanical Survey of India: P.S.N. Rao (algae), J.R. Sharma (fungi), K.P. Singh and G.P. Sinha (lichens), D.K. Singh (liverworts), J.N. Vohra (mosses). It is also taken from the following sources: Dixit, R.D., 1984, *A Census of the Indian Pteridophytes*, Flora of India Series IV, Botanical Survey of India, Calcutta; Nayar, M.P., 1987, "*In situ* Conservation of Wild Flora Resources", *Bull. Bot. Surv. India*, Vol. 29. Information on the world figures is from: United Nations Environment Programme, *Guidelines for Preparation of Country Studies*; World Conservation Monitoring Centre, *Global Biodiversity*.
3. It should be noted that the total figure given by most authorities (including the Botanical Survey of India) for plants in India (including groups recently classified as micro-organisms) is 45,000 (e.g. Nayar 1987), but the total of the divisions given here from various different sources comes to just over 36,000. This discrepancy has yet to be resolved.
4. The figures given here are from a table sent by Dr. N.V. Subba Rao, Deputy Director, Zoological Survey of India, to the Indian Institute of Public Administration, on 3 February, 1994.
5. Many of the invertebrate animal groups do not have a common name, hence the symbol "—", or the generic description "worms."

APPENDIX 2

DOMESTICATED BIODIVERSITY OF INDIA

The following tables are adapted from the draft of *Conservation of Biological Diversity in India*, a report under finalization at the Indian Institute of Public Administration (IIPA), under sponsorship of the Ministry of Environment and Forests, Government of India. The data presented are provisional, and may not be conclusive.

Table 1: Crop genetic diversity of India[1]

Crop	*Indigenous varieties*	*Crop*	*Indigenous varieties*
Potato	16	Cardamom	226
Rice	50000-60000	Ginger	124
Cotton	1975	Turmeric	184
Sorghum	5160	Clove	150
Cassava	701	Nutmeg	301
Sweet Potato	495	Cinnamon	4
Yams	305	Tea	1607
Aroids	350	Rubber	103
Minor tuber crops	78	Arid and semi-arid fruits	380
Coconut	42	Mango	>1000
Arecanut	45	Sugarcane	48
Pepper	500	Groundnut	80

Table 2: Animal genetic diversity of India[2]

Animal	*Indigenous varieties*	*Animal*	*Indigenous varieties*
Sheep	40	Horses & ponies	6
Camel	4	Buffalo	8
Yak	1?	Cattle	26
Pig	2	Poultry	20
Goat	20	Ducks	4
Donkey	2?		

NOTES

1. Information is from the following sources (obtained in 1992 as part of the preparation of the IIPA report mentioned above): C.L. Khushu, Central Potato Research Centre (potato); S.D. Sharma, Central Rice Research Institute (rice); S.S. Narayana, Central Institute for Cotton Research (cotton); U.R. Murty, National Research for Sorghum (sorghum); T. Ashokan Nambiar, Central Tuber Crops Research Institute (cassava, sweet potato, yams, aroids, minor tubers); R.D. Iyer, Central Plantation Crops Research Institute (coconut, arecanut, pepper, cardamom, ginger, turmeric, clove,

nutmeg, cinnamon, tea, rubber); O.P. Pareek, All India Co-ordinated Project on Arid Zone Fruits (arid/semi-arid fruits); S.S. Negi, Central Institute of Horticulture for Northern Plains (mango); Director, Sugarcane Breeding Institute (sugarcane); P.S. Reddy, National Research Centre for Groundnut (groundnut).

2. Information is from the following sources: Council of Scientific and Industrial Research, 1970, *Wealth of India: Raw Materials Vol. VI—Livestock (Including Poultry)*, New Delhi; Khanna, N.D., 1993, "Camel Genetic Resources and Camel Production in India", paper presented at the National Seminar on Animal Genetic Resources and Their Conservation, April 22-23, 1993, Karnal, Haryana, National Institute of Animal Genetics, National Bureau of Animal Genetic Resources, and Nature Conservators; Mohapatra, S.C. and Panda, B., "Poultry Genetic Resources of India", in *Indian Poultry Industry Yearbook*, 1981, Central Avian Research Institute, Izatnagar; Sahai, R., 1993, "Animal Genetic Resources Scenario of India", paper presented at the National Seminar of Animal Genetic Resources and Their Conservation, Karnal.

APPENDIX 3

SOME INDIAN CITIZENS' GROUPS INVOLVED IN THE CONSERVATION OF ON-FARM CROP GENETIC DIVERSITY

This is by no means a comprehensive list, just an indicative one.

1. Academy of Development Science, Kashele, Tal. Karjat, Dist. Raigarh 410201, Maharashtra.
2. Auroville Green Resources Centre, c/o Isaiambalam School, Kottakarai, P.O. Irumbgai, Auroville 605101, Tamil Nadu.
3. Beej Bachao Andolan (Save the Seeds Movement), P.O. Nagani, Tehri Garhwal 249175, Uttar Pradesh.
4. Centre for Indian Knowledge Systems, No. 2, 25th East Street, Tiruvanmiyur, Madras 600041, Tamil Nadu.
5. Deccan Development Society, A6 Meera Apartments, Basheerbagh, Hyderabad 500029, Andhra Pradesh.
6. Friends Rural Centre, Rasulia, Hoshangabad 461001, Madhya Pradesh.
7. Gene Campaign, F 31 Green Park (Main), New Delhi 110016.
8. Indian Rural Reconstruction Movement, 506 9th Main, 3rd Cross, HAL 2nd Stage, Indiranagar, Bangalore 560008, Karnataka.
9. Indian Society for Rural Gene Banks, E5, Guruprasad, 90 Feet Cross

Road, Arunodaya Nagar, Mulund (E), Bombay 400081, Maharashtra.
10. M.S. Swaminathan Research Foundation, 3rd Cross Street, Taramani Institutional Area, Madras 600113, Tamil Nadu.
11. Navdanya, A-60, 2nd Floor, Hauz Khas, New Delhi 110016.
12. Navadarshanam, (field address) Gangenahalli Village, Gumalapuram P.O., Thally 635118, Dharmapuri Dist., Tamil Nadu.
13. PREPARE, No. 4, Sathalvar Street, Mugappair West, Madras 600050, Tamil Nadu.
14. Ramakrishna Mission Lokasiksha Parishad, Narendrapur 743508, South 24-Parganas, West Bengal.
15. Samvardhan: Association for the Propagation of Indigenous Genetic Resources, D-1, Aurobindo Society, Vastrapur Talavadi, Ahmedabad 380015, Gujarat.
16. Sanvad, c/o Karuna/Vasant. Vill. Ravala, PO Satnur, Tal. Varud, Dist. Amravati 444907, Maharashtra.

APPENDIX 4

LEGAL COVERAGE OF VARIOUS ASPECTS OF BIODIVERSITY IN INDIA

A survey of the legal status of biodiversity in India was conducted by the Indian Institute of Public Administration at the request of the Ministry of Environment and Forests, in 1992.[1] For the purposes of this paper, biodiversity components were categorized into five heads:

1. Wild fauna
2. Wild flora
3. Domesticated fauna (livestock)
4. Domesticated flora (crops and other cultivated plants)
5. Genetic materials (seeds, eggs, germplasm, semen, etc.)

Forty central laws, listed below, were analysed from the viewpoint of their coverage of the following aspects of biodiversity:

Identification: The process of locating, and thereafter establishing the identity, distribution, occurrence, status, and value of biodiversity components. Relevant to both wild and domesticated fauna and flora.

Protection in situ: Efforts at protecting and conserving biodiversity, including the habitats within which biodiversity components survive and evolve. Applies especially to wild fauna and flora, but also to domesticated fauna and flora at the sites of their use, in so far as these may need to be protected from disease/infection, displacement by new varieties, and destruction due to human activities.

Protection ex situ: Attempts at preserving living species or genetic material in gene banks, zoological parks, botanical gardens, and sites other than their natural habitat. Relevant to all biodiversity components.

Access/extraction: Controls on the kind and amount of access to fauna and flora in the wild, to *ex situ* collections, and to genetic material; also the modes of extraction of these components, relevant especially to *in situ* stock. Overlaps with Intellectual Property Rights, below.

Use: Attempts at utilizing biodiversity for subsistence, commercial, scientific, or other purposes. Relevant to all biological components.

Breeding/Cultivation/Multiplication: Artificial or induced measures for regenerating flora-fauna populations in captive or closed conditions. Relevant to both wild and domestic fauna and flora.

Trade: Activities relating to the barter, sale, import, export, and other forms of exchange of biodiversity components.

Introduction/Augmentation/Re-introduction: Measures to deliberately stock an ecosystem or area with species which did not previously exist there (introduction), or where they have declined or need to be increased in number (augmentation), or where they have died out (re-introduction). Relevant to both wild and domesticated fauna and flora, as also to genetic material (e.g. seeds) used for the purpose.

Release: Disposal of biodiversity components, without the specific purpose of introducing, augmenting, or re-introducing them, into the environment. Relevant to all biodiversity components.

Movement: Measures to transport, by human means, biodiversity components from one location to another; especially relevant in cases of transportation across ecosystems or bio-regions, involving the possibility of accidental release of components. Does not include natural or voluntary movement of animals, or movement of seeds or other floral parts by natural means. Relevant to all biodiversity components.

Intellectual property rights: Measures pertaining to the rights of the state, organizations, or individuals, over biological and biotechnological knowledge, including patents, royalties, intellectual property rights, farmers' rights, and breeders' rights.

Laws analysed: The 40 Acts analysed for their coverage of these aspects are:

1. Fisheries Act, 1897
2. Live-stock Importation Act, 1898
3. Destructive Insects and Pests Act, 1914
4. Forest Act, 1927

5. Sugar-cane Act, 1934
6. Agricultural Produce (Grading and Marking) Act, 1937
7. Agricultural Produce Cess Act, 1940
8. Drugs and Cosmetics Act, 1940
9. Coffee Act, 1942
10. Import and Export (Control) Act, 1947
11. Rubber Act, 1947
12. Drugs (Control) Act, 1950
13. Tea Act, 1953
14. Medicinal and Toilet Preparations (Excise Duties) Act, 1955
15. Prevention of Cruelty to Animals Act, 1960
16. Customs Act, 1962
17. Marine Insurance Act, 1963
18. Cardamom Act, 1965
19. Seeds Act, 1966
20. Patents Act, 1970
21. Wild Life (Protection) Act, 1972
22. Marine Products Export Development Authority Act, 1972
23. Water (Prevention and Control of Pollution) Act, 1974
24. Conservation of Foreign Exchange and Prevention of Smuggling Activities Act, 1974
25. Tobacco Board Act, 1975
26. Territorial Waters, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Act, 1976
27. Coconut Development Board Act, 1979
28. Forest (Conservation) Act, 1980
29. National Bank for Agricultural and Rural Development Act, 1981
30. Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981
31. Air (Prevention and Control of Pollution) Act, 1981
32. National Oil Seeds and Vegetable Oils Development Board Act, 1983
33. Prevention of Damage to Public Property Act, 1984
34. Inland Waterways Authority of India Act, 1985
35. Spices Board Act, 1986
36. Agricultural and Processed Food Products Export Development Authority Act, 1986
37. Environment (Protection) Act, 1986
38. Spices Cess Act, 1986
39. Consumer Protection Act, 1986
40. National Dairy Development Board Act, 1987

Adequacy of Legal Coverage: An analysis of the 40 acts was done to judge whether or not they covered the above aspects for wild flora and fauna, domestic flora and fauna, and genetic material, and if covered, whether the coverage was adequate. This analysis is presented below.

It must be noted that the term "well covered" below does not imply that there is complete or perfect coverage, or no room for improvements. It also does not, of course, indicate whether the implementation of these acts is satisfactory or not.

		Wild		*Domestic*		*Genetic Materials*
		Fauna	*Flora*	*Fauna*	*Flora*	
1.	Identification	N	N	N	N	N
2.	Protection *in situ*	W	W	N	N	N
3.	Protection *ex situ*	W	P	N	N	N
4.	Access/Extraction	P	P	N	N	N
5.	Use	W	P	W	N	N
6.	Trade	W	W	P	W	P
7.	Breeding/Cultivation/ Multiplication	W	P	P	P	P
8.	Introduction/Augmentation/ Re-introduction	P	P	P	P	P
9.	Release	N	N	N	N	P
10.	Movement	W	P	P	P	P
11.	Intellectual property rights	N	N	N	N	N

N = Not covered, P = Partially covered, W = Well covered

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Biodiversity, IUCN/International Academy of Environment, 1994, This appendix is a summary of the paper.

APPENDIX 5

SOME INDIAN PEOPLE/ORGANIZATIONS WORKING ON THE BIODIVERSITY CONVENTION

This is not a comprehensive list, just an indicative one.

1. Sujata Arora, G.V. Sarat Babu, K.P.S. Chauhan, Ministry of Environment and Forests, Paryavaran Bhawan, CGO Complex, Lodi Estate, New Delhi 110003.
2. Madhav Gadgil, Centre for Ecological Sciences, Indian Institute of Science, Bangalore 560055.
3. Anil Gupta, Srishti/RM Centre for Educational Innovation, Indian Institute of Management, Vastrapur, Ahmedabad 380015.
4. Anjali Prasad, Deputy Secretary, Ministry of Commerce, Udyog Bhawan, New Delhi 110011.
5. Usha Menon, National Institute for Science, Technology, and Development Studies, NPL Campus, Delhi 110012.
6. Suman Sahai, Gene Campaign, F31 Green Park (Main), New Delhi 110016.
7. Ravi Sharma, Centre for Science and Environment, 41 Institutional Area, Tughlaqabad, New Delhi 110062.
8. Manju Sharma, Advisor, Department of Biotechnology, Block 2 (7th Fl.) CGO Complex, Lodi Estate, New Delhi 110003.
9. Usha Sharma, Director, Department of Science and Technology, Technology Bhawan, New Mehrauli Rd., New Delhi 110016.
10. Vandana Shiva, Third World Network/Navdanya, A60 Hauz Khas (2nd floor), New Delhi 110016.
11. Chhatrapati Singh, Centre for Environmental Law, World Wide Fund for Nature—India, 172 Lodi Estate, New Delhi 110003.
12. Samar Singh, Secretary-General, World Wide Fund for Nature—India, 172 Lodi Estate, New Delhi 110003.
13. Shekhar Singh, Indian Institute of Public Administration, I.P. Estate, New Delhi 110002.
14. M.S. Swaminathan, Centre for Research on Sustainable Agriculture and Rural Development, 3rd Cross Street, Tharamani Institutional Area, Madras 600113.
15. C.K. Varshney, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110067.

APPENDIX 6

TOWARDS A NEW WILDLIFE POLICY

From the experience of various PAs in India, a tentative process of minimizing and resolving conflicts can be evolved. There can first be an initial declaration of intent, following which all urban-industrial expansion in the proposed area will be banned. Then the following steps should be taken to:

1. **Determine the conservation significance of the proposed protected area, and identify priority conservation objectives, with the help of both local traditional knowledge of the area, and modern ecological research. Then declare intention to give the area protected status.**

Note that management strategies may differ radically for different objectives (e.g. threatened or endemic species protection, wetland conservation, watershed protection, etc.). A strategy which prescribes the same management regime for every area may not only be ecologically unwarranted, but also unrealistic, given the human dependence and other social factors bearing on the area. Social action NGOs also need to understand conservation priorities, especially with regard to threatened wildlife species, much better than they usually do.

Once the values are specified, a declaration can be made regarding the intent to conserve the area and all subsequent urban-industrial projects or expansion should be barred. However no local community activities can be curtailed till steps are initiated to.

2. **Analyse the precise range of human dependence and rights/leases on the protected area, the impacts of each resource use, and the implications of these uses for the area's conservation objective, without assuming *a priori* that each kind of use is necessarily contrary to the objectives of conservation.**

As discussed above, it must be recognized by conservationists that certain kinds and levels of human activity can co-exist with the biodiversity of the area. Such activities and the knowledge they are based on, should be protected and encouraged, as a safe means to build a local stake in conservation. Also to be considered are measures that local communities themselves may have been taking to achieve sustained resource utilization, or to set aside patches such as sacred forests, and the forces which may have caused the decline of such practices. It is rather unfortunate that there is not a single protected area in India where traditional conservation practices have been taken into account and integrated into the management of the area. But conversely,

the decline of such traditions due to changed circumstances must also be considered.

There is currently considerable ambiguity about the issue of local community rights, since many of these were dealt with decades ago. One urgent step to be taken all over India will be to inquire into the nature of people's rights and concessions, and to clarify their legitimacy and desirability in the context of the twin objectives of conservation and ensuring people's livelihoods. This has also to be a fully participatory exercise, not one unilaterally conducted by a district collector or settlement officer.

3. **Review the history of land use in the area, in order to understand the various factors which have gone into the making of the current situation.**

Unequal land-holdings, encroachments, take-over of lands by government or corporations, conversion of pastures to other uses, and other changes in land use patterns can have severe impacts on natural habitats, especially when poor people are forced to over-exploit resources as a result. But officials or wildlife researchers rarely look into the history and origin of current land use, by going into gazetteers, anthropological accounts, and the oral history of the local people themselves. Such an exercise would provide crucial insights into possible solutions to conflicts.

4. **Determine the appropriate legal status for the protected area, or of separate parts of the protected area; expand the range of PA categories.**

The Wildlife (Protection) Act allows only two categories of protected areas, national parks and sanctuaries. This is an inflexible system, and requires expansion into several categories, to be sensitive to the diversity of local ecological and social situations. There are six different categories defined by the World Conservation Union (IUCN), which are distilled from a bewildering variety of PAs worldwide: strict nature reserve; national park; national monument/landmark; habitat/species management areas; protected landscapes/seascapes; and managed resource protected areas.[1] These categories can be gauged for their applicability to India, but we may also need to develop our own categories. In particular, we should explore the potential of biosphere reserves and people-protected areas to reduce people-wildlife conflicts. I would argue that eventually the act needs to be modified to allow such flexibility.

Even within a single PA, varying management categories may be desirable. The commonly accepted opinion is that protected areas can

contain both no-use and limited or restricted-use areas, and that this can be achieved through appropriate zoning in which a single core or multiple core zones are surrounded by buffer zones where human activity is allowed. Such a concept has been part of PA strategy for long. However, what is not yet recognized is that *such zoning must be done in full consultation with local communities, and should take into account existing practices and beliefs* (e.g. related to sacred groves). In addition, the concept of several 'mini-cores' in contrast to one big core, where the latter is not possible due to socio-economic constraints, has been mooted. Such a zoning process and strategy has been recently suggested, for instance, for Rajaji National Park.[2]

It may even be useful to look at traditional terminology, e.g. local terms for sacred groves as a replacement for the term "core zone", wherever relevant. Why cannot the inviolable zone of the Sariska Tiger Reserve, declared in consultation with local villagers, be called the Sariska *oraon*?

An immediate task then would be to review the existing 500 PAs in India and assign new categories and zoning practices where necessary. For instance, if the area of the Nargu sanctuary of Himachal Pradesh (see above), which has 170 villages, is to be given a PA status because of some wildlife value, it could be a multiple-use PA category. In another case concerning the Great Himalayan National Park of Himachal Pradesh, two villages in the Sainj area were to be relocated as per rules of the national park. On the recommendation of researchers,[3] the inhabited part of the park has been converted into a sanctuary, so that the villages do not have to be moved out. A similar exercise is urgently needed to review the legitimacy and rationality of the legal status of every one of India's protected areas.

5. **Conduct participatory exercises to build up a management plan for the protected area, providing as central a role to local communities as to the wildlife bureaucracy.**

Apart from stating the ecological features and conservation objectives of the proposed protected area, and the broad strategies to achieve these objectives, the plan should clearly demarcate the role of each collaborative partner in the management. This would include the precise nature of rights, responsibilities, and functions of each. Too often arrangements break down if there is ambiguity in the definition of these roles; on the other hand, there has also to be some flexibility to allow for modification based on learning. The institutional structure for management also needs to be delineated.

Once again, there is a need for changes in the Wildlife Act to

accommodate joint management institutional structures, since currently the act provides for management only by the official wildlife wing/department. I expect maximum resistance from officials on this, but I firmly believe that this is one of the most critical steps towards building faith and trust, and towards a resolution of conflicts.

One of the most important steps needed is to revive in local communities a sense of control, or as anthropologist B.K. Roy-Burman says in the special context of tribals, a custodial association. There is a need to study the diversity of experiences on how either government or community control has worked towards conservation of natural habitats. Further, what could the respective sharing of ownership, powers, rights, responsibilities, and functions of each partner in a joint management system be? I strongly feel that the Forest Department will have to give up its exclusive control over at least a part of the 23 percent of India's land which it currently owns, in favour of the communities from whom this land was wrested in the first place. But since many communities, may for various reasons be unable or unwilling to conserve forests on their own, the transfer of power will have to go hand in hand with a mandatory responsibility for conservation. The non-fulfilment of this responsibility could lead to an abrogation of rights and control. A collaborative management contract between Uganda's Bwindi National Park authority and local villagers, for instance, has built in such checks.[4] Similar checks should, of course, apply to the Forest Department (or other relevant government agency). Scientists at the Indian Institute of Science have recently proposed a People's Nature, Health and Education Bill which envisages the creation of natural resource management committees at various levels, and suggests a system of checks and balances to ensure conservation and sustainable use by all concerned parties.

Also of critical importance will be a process of dispute settlement in the case of heterogeneous local communities, where severe internal disparities and tensions often subvert a common approach, or where some members of the community are tied into a market system which is over-exploiting the area's resources. The catalytic or mediatory role of NGOs could be crucial here.

In this connection, the demand that protected areas be "handed over" to local communities for management is also often unrealistic. Traditional practices and institutions have in many places broken down, market forces have infiltrated, village bodies have become highly politicized and corrupt, and younger generations are less inclined to follow traditional paths than their elders. For instance, at Rajaji National

Park, some NGOs have stridently demanded that the area be "handed over" to the Gujjar pastoralists—but who will control poaching when the Gujjars migrate out of the park, and even when present, how will they be able to counter the powerful timber mafia? It is interesting that villagers often recognize their own limitations; in early 1995, participants of the Jungle Jivan Bachao Yatra, which visited local communities in and around 166 protected areas, found that villagers who were extremely vocal in their opposition to top-down conservation, were also clear that they on their own would not be able to withstand destructive forces.

6. **Determine the precise sharing of benefits of the protected area and its resources with local communities, both as a recognition of their customary rights as also to give them a stake in conserving the area.**

As discussed above, the goal of having human-free protected areas in a country like India is socially and politically unrealistic. Nor, in many cases, is it necessary. Since many traditional and low-impact activities may fit within the conservation priorities of PAs, giving them legitimacy will help to gain people's support for the protected area. Thus guaranteed rights to the sustainable extraction of biomass from specified zones, conversion of monoculture plantations into multi-species fodder/fuel stands, employment in PA related activities, a share in the decision- making about and revenue from tourism, returns for the use of traditional knowledge and skills on the basis of community intellectual rights and appropriate development inputs (including some of the activities being proposed in current eco-development plans), are benefits which local communities should derive. Of these, low-intensity extraction of non-timber forest produce (NTFP) and fodder could be the most widespread benefit from PAs in India. As mentioned above, about two-thirds of PAs surveyed in the mid-1980s already had such dependence. In many cases, the creation of cooperatives or other institutional structures, or the provision of appropriate technological inputs, can make such activities even more beneficial and sustainable. What is most attractive about NTFP (including, for instance, medicinal plants and honey) is that sustainable returns are possible only if habitat integrity and biodiversity are maintained, thereby becoming a powerful argument for habitat conservation. In the Biligiri Rangaswamy Temple Sanctuary of Karnataka, some NGOs are promoting medicinal plant conservation areas, where local tribals will be involved in protection, *ex-situ* conservation and propagation, and medicinal uses of plants. In such situations, the peerless knowledge of local communities regarding

their natural surrounds can be most effectively hardnessed. Such approaches are being pioneered in a number of PAs across the tropics.[5]

The formalization of benefit-sharing arrangements is also necessary; this could be in the form of contracts between local communities and government agencies, as has been done recently in the case of a couple of national parks in Uganda. This would also help to minimize the subsequent entry of vested interests from outside, who might want to take advantage of the situation.

Finally, since local people often have to suffer damage to human lives, livestock, and crops by wild animals against whom they cannot retaliate, there must be an efficient, reasonable, and speedy system of compensation. Methods to judge the amount of compensation have still to be perfected, but while errors persist, they must be on the side of giving local people the benefit of doubt.

7. **For activities which are clearly and demonstrably detrimental to conservation objectives, devise viable alternatives; relocate people only when voluntarily acceptable.**

Undoubtedly, in many places, changes in modes of resource extraction and land use, increases in human and livestock population, commercialization, and other factors have altered what may at some time have been sustainable resource use. Measures to revive sustainability, or to provide alternatives, are therefore an important part of protected area management. There is nothing new in this; in some PAs (e.g. the Sundarbans in West Bengal), alternatives have been successfully provided. But what is vital in a system of joint management is that existing activities must first be shown to people as having a demonstrable, or understandable, negative effect, and that even the process planning and implementation of alternative biomass resources, or employment opportunities, must be participatory to be fully successful. Conventional top-down rural development approaches will not work. The above-mentioned efforts at eco-development are promising to do this in what is called "participatory micro-planning"; their success can only be gauged over the next few years.

Actual displacement of people, if found in a participatory exercise to be absolutely necessary, must only be with the willful consent of the affected people. I would strongly oppose forcible displacement of populations from within protected areas; this is unjust, and an invitation to trouble from either the people themselves, or from political interests who move in to take advantage of the situation.

8. **Institute a transparent, regular, and systematic monitoring process, involving all the partners.**

Systematic monitoring of the success or failure of management strategies, in terms of the conservation objectives determined in step 1 above, would provide important indicators to modifications or new directions which may be required. Indian protected areas have some monitoring in the form of animal censuses, or forest cover mapping, but most other indicators are not assessed, nor is the process often open to public involvement and scrutiny. Such a monitoring process is urgently needed.

9. **Conduct regular participatory training and educational exercises, for mutual learning between protected area staff, local people, visitors, and others; improve the flow of information.**

With a few exceptions, efforts of protected area authorities towards education have so far been restricted to the occasional film-show during the wildlife week, and the attitude has been that villagers are the ones who need to be taught. However, there is a need for education and learning all around, since knowledge about habitats, wildlife, and human-wildlife interaction is not found exclusively with a particular sector of people. Many social activists are notoriously uneducated about wildlife issues, and many wildlife ecologists and forest officials have no clue of the social dynamics which could be influencing the management of habitats. Most external actors know little about the local community's own knowledge. All 'partners' need to learn a lot from each other.

10. **Improve management conditions.**

There is an urgent need to improve the field conditions and training of official PA staff, provide more secure and longer tenures at each field site, reduce rigid hierarchies, and commit more resources to PAs. Unfortunately, this is dependent on the discretion of state governments, for whom PAs are not high priority. This also underlines the importance of gaining local community support for conservation, for mass public support can help to pressurize governments into committing more management resources.

11. **Coordinate the activities of various government agencies.**

Considerable sums of money are spent in and around PAs by various rural development agencies, without any coordination with the wildlife authorities, and frequently in violation of conservation objectives. For instance, the Tribal Welfare Department often promotes goat rearing; while forest officials are desperately trying to reduce grazing. There is a need to harmonize the programmes and objectives of government agencies which have an impact on PAs and their surrounds. Such coordination was achieved some years back for the Melghat Tiger Reserve in Maharashtra by a motivated district collector,[6] who reported

that he mobilized over 2.5 crore rupees for eco-development in the area, from the budgets of various rural development agencies working in Melghat. This, and similar efforts elsewhere, could be used as models for other areas as well.

12. **Redefining development policies; redistributing land.**

The most critical need is for an overall land-use policy which strictly limits industrial-urban growth; and redistributes land in favour of the poor. *This calls for a drastic reorientation of the economic development policy which India currently follows.* Neither the urban conservation class, nor the government bureaucrat, is capable of achieving this on their own: there is thus a need for the conservation effort to unite with the many mass movements which are challenging 'development' projects and paths, and the struggles to redistribute land and regain community control over land and forests. Indeed, it is the people who lead such movements who have recognized that there is an artificial divide between conservation and human rights interests. For instance, the recent massive protests of India's traditional fisherfolk against the move of the Indian government to introduce trawling ventures, were prompted by concern both for the livelihood of these fisherfolk and the ecological health of the seas. In a significant development, conservation groups and movements in Bombay recently came out with a joint statement of protest against the denotification of PAs; signatories included members of the Narmada Bachao Andolan, the Kashtakari Sanghatana, the Bharat Jan Andolan, and various other movements which are spearheading the fight against unjust and unsustainable development policies, and which have conventionally not considered wildlife conservation important enough. In another interesting development, activist Medha Patkar of the Narmada Bachao Andolan wrote to the Prime Minister urging him to take steps to save the tiger.

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Understanding Biodiversity comes as a wake-up call at a time when the predatory practices of our 'modern' civilization have transformed nature into an exploitable resource, opened up our plant and animal life to endless expropriation and eroded the biodiversity that has made our life on earth possible. This tract forces us to confront basic issues : the need to conserve biodiversity, the conservation of wildlife and wildlife habitats, our protectionist policies which have more often endangered than conserved, our agricultural policies that have encouraged monocultures at the expense of indigenous varieties and genetic diversity. Also examined are the complex issues of access to biodiversity, the equitable sharing of benefits, patents and intellectual property rights, the Convention on Biodiversity and its relevance to India. The tract is a passionate plea to rethink our development priorities, re-evaluate our wildlife and agricultural strategies, and our relations between and within nations.

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